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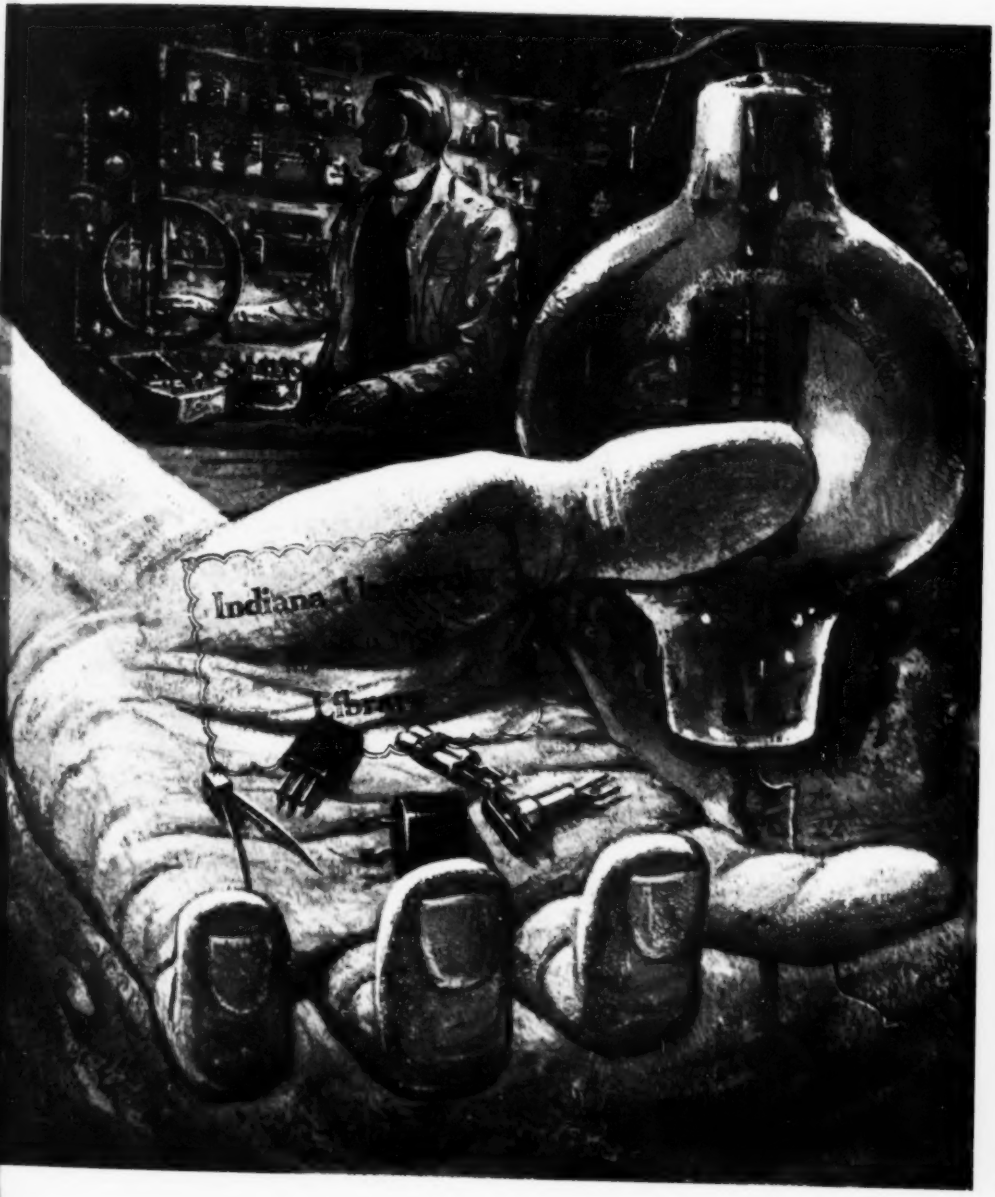
SPRING 1956



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Bell Telephone Magazine

A non-technical review, published quarterly to give Bell System management people a broader view of the history, objectives, operations, and achievements of this business than they might attain in the course of their day-to-day occupations, and an added sense of participation in the problems and accomplishments of our nation-wide public service.

Cover: "The Future of This Business." Painted for this Magazine. *Henry Stoessel*

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A MEDIUM OF SUGGESTION and A RECORD OF PROGRESS

JUDSON S. BRADLEY, *Editor* SALVATORE J. TAIBBI, *Art Editor*

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Who's Who & What's What

IN THIS ISSUE

THE EVER-UPWARD COURSE of America which BARTLETT T. MILLER sees *in continuum,* as he prepares for retirement later this Spring, he is able to sight in long perspective; for his telephone days run back to 1910, when he joined what is now the Mountain States Telephone and Telegraph Company. Moving Eastward to the New England Telephone and Telegraph Company in 1923, he served there in various offices and States until in 1944 he was elected vice president in charge of Public

Ralph Bown

Bartlett T. Miller

Relations. The following year he became vice president and general manager of the company. Moving to New York in 1946, he was successively an assistant vice president in A. T. & T.'s Department of Operation and Engineering, vice president in charge of Long Lines, a staff vice president at 195 Broadway again, vice president at the head of Public Relations, and finally—in February of 1955—vice president of the newly created Merchandising Department. His most recent of several contributions to this MAGAZINE, in the issue for Spring 1955, was "Merchandising: What It Means for Our Business."

ANTICIPATING BY A FEW MONTHS Mr. Miller's final move as a telephone man,

Melvin Anshen

RALPH BOWN retired last February as vice president of Bell Telephone Laboratories. Joining the predecessor organization—the engineering department of Western Electric Company—in 1919, Mr. Bown had become by 1934 assistant director of radio research of the Laboratories. This post was expanded to director of radio and television research in 1936. In 1944 he was appointed assistant director of research, became director in 1946, and was made vice president in charge of research in 1951. From 1954 until his retirement he was vice president in charge of long range planning of Laboratories programs. Much of Dr. Bown's work was concerned with various aspects of radio broadcasting, overseas telephony, and radio relay. He was a division member and consultant of the National Defense Research Committee specializing in radar, and an expert consultant to the Secretary of War; and in 1941 he visited England to study radar operations under combat conditions. To this MAGAZINE for Spring 1954 he contributed "What Is Science Doing to Electronics?"

AS AN OUTSIDE CONSULTANT and discussion leader, MELVIN ANSHEN has been associated with the Bell System Executive Conference since the days of its planning and early operation in 1953—which were described in this MAGAZINE for Spring 1954. More recently he has had a part in the establishment of the *Advanced* curriculum, which is his subject in these pages. Currently on the faculty at Carnegie Tech's Graduate School of Industrial Administration, his academic background includes degrees from Harvard College and Harvard Business School, and teaching assignments at Indiana University, Harvard Business School, and Stanford School of Business. He had government experience with the War Production Board dur-

(*Continued on page 59*)

M. K. Jordan

Concentration: A small group considering one of the basic problems encountered during the Advanced Bell System Executive Conference

Aggressive promotion, by soundly planned merchandising, holds the key to realization of the almost limitless potentialities of this business

THE COURSE OF AMERICA IS UPWARD

BARTLETT T. MILLER

Vice President, MERCHANDISING DEPARTMENT, A. T. & T. CO.

THE POTENTIALITIES of this telephone business of ours seem almost fantastic. It is the one facility which provides a means whereby people may talk to each other wherever they are, at whatever time, and for any length.

As duties or occupations tend to separate friends and family, the means for maintaining frequent, convenient, and every-day small talk or serious contact is restricted more and more to the telephone. One can see this trend toward separation in building developments. More and more they extend on the periphery of cities and towns, where population growth continues while that of the cities diminishes. If one is not to be isolated from friends and relatives, then transportation or communication must provide the connecting link. Home life and household duties and inadequate facilities prevent free and easy transportation—making the telephone the natural and easy medium.

There are more and more people, in sheer numbers, every year. Population growth sometimes seems as sure as death and taxes; and as the population increases, while at the same time a lowered death rate resulting from public health measures and developments in scientific medicine increases the span of life, the number of potential telephone users increases very rapidly. Over the next few years, a million new families will be created every year, and a few years later that number will increase to a million and a half—so that basically there will be a continuing increase in the user market for many years to come.

At the end of 1954 there were said to be forty-seven million households in the United States. Fourteen million had no telephone service, twenty-nine million had only one telephone, and twenty million shared service with others. A very substantial number of these households are in ultra-modern homes—some with as many as 40 or more electrical services. The number of families with two cars, two or three bathrooms, two television sets, runs into many millions, and most of those who don't have them want them

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very badly. In all these cases, "wants" exceed "needs." All, or almost all, have more conveniences than they *need.*

Our economy and our "American way of life" are geared to satisfying *wants.* People want things they don't really need, and they buy them—and that is what makes a high level of economy. If we all bought only what we needed and nothing else, we would be in a perpetually low economy. We in the telephone business have, on the contrary, geared our activities to customers' *needs,* and in large measure we, not they, have decided what was needed. We have done very little to cater to this huge market in the sense that other businesses have. Others tempt it with high style, with color, with glamour.

We have generally assumed that because an instrument was technically good and strong, the one type should serve both the lady in her boudoir and the mechanic in his shop. We have not tried to find out—or not very diligently, at any rate—what are the communication possibilities of the average family: how they live, what they want in the way of style, color, and so on. When we have done so, and have made an honest effort to meet their *wants,* we shall certainly be amazed at the potential.

If we should give serious consideration to designing and promoting a home telephone *system,* it is not unreasonable to expect that average development might reach two and even three telephones per residence in better than 90 per cent of residences. This could mean that by 1965 or '70, when we have 45 million homes in the Bell System territory, we could have a hundred million telephones in those homes instead of the thirty million or so that we now have.

Coincident with this growth we should stimulate usage of the service—dependence on it. In a number of indirect ways we have really discouraged calling by

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telephone. We have encouraged party lines—sharing the service with others. We have used measured service as a development rate, and thus taught customers to keep down their calling. We have talked so much about party-line interference and shared-line courtesy – implying a naturalness of party line—that state laws have been passed regulating use under certain circumstances, and some commissions have suggested limiting length of conversations on party lines. But the worst thing, I believe, is that we have encouraged the belief that the principal benefit of the telephone is for emergencies and very important calls—to the extent that the real comfort and neighborliness of friendly chats and visits are frowned on by husbands and ridiculed by the cartoonists as trivia and inexcusable loafing. Chit-chat is the food on which friendships thrive—and the telephone ought to be the symbol of friendship.

Of course, if these hundred million residence telephones are used as we hope they will be and as they should be, business telephone requirements would be very substantially increased; because the interplay of business and residence services indicates there is a reasonably close relationship between the two. This increase in telephoning between home and business, together with the growth of business to serve this growing America—not to mention the improvement in communications devices that we see on the horizon—will bring about a similar substantial increase in the telephone requirements of business users. This will match, if indeed it does not exceed, the expansion in home telephone development.

This network of over a hundred million telephones, interlinked with long distance channels in the packages in which we shall be able to furnish them, will make possible almost unlimited long distance calling. "Free and easy" long distance calling could however be hampered by busy party lines and inadequate number service. We should therefore do everything we can to eliminate the "shared" services and, as quickly as we can, develop perhaps an entirely new system by which the number of any telephone can be quickly and easily secured.

To do all this, we must take command of our ship, so to speak; we must wrest control of it from the seas of demand which have buffeted it in the last ten years. We must plan ahead. We must believe we can create markets, and we must learn how. We must anticipate the public's desires and be ready to meet them, and we must use aggressive promotion—the kind that competitive business constantly employs. This must be the spirit that triggers all our activities—a spirit that recognizes that what America desires today will be America's need.

To do less is to declare ourselves apart from the very essence of the dynamic spirit that has made this country different from the Old World. The market is there, of that I am sure, and we can do it if we put our minds to it. Three lamps per room and three bathtubs per home did not come about merely because the people wanted them and were ready to pay for them. They came about because American business enterprise saw a potential market and set out to develop it aggressively. It is this same spirit of enterprise that conceived the Bell System, and we must be ingenious enough to keep it alive despite our increasing size and despite the absence of the spur of direct competition. I have explicit faith that we can accomplish

anything we decide we want to accomplish.

STRICTLY SPEAKING, we have not built the telephone business to its present size by aggressive promotion. It has developed almost in spite of us because, unfortunately, we have had to employ retarding methods so many times. The two tremendous growth periods in our country were subsequent to the two world wars, and during both of these periods we not only had inflation but, since the materials we use in building telephone plant are the same that for war purposes are strategic, we had to step aside in our requirements to make way for defense. Fortunately for the growth of the business, if not for the prosperity of the Companies, the rates for post-war telephone service have proved to be relatively lower than the cost of other wanted things. Unstimulated "demand," together with the social decentralization of our population, has therefore provided our growth to the point where over 73 per cent of all families now have some kind of telephone service. If demand stimulation were aggressively used, we could undoubtedly increase this development to 90 per cent or 95 per cent of all families.

We shall probably always have business cycles, but I would doubt that they would be of the same violence as some which have occurred in the past. But whether these fluctuations be relatively large or small, we must have courage to see beyond them. *The long course of America has always been upward. We must, in a dip, keep a serene faith in this fact and, in a down spell, look forward in our actions and decision to this ever-upward long course.* This is something that, in the past, we have never been able to do, but which we can and must do in the future.

To me, this faith in the future of our country and the part the System plays in it is the real essence of the merchandising idea. It is, I think, a philosophy that telephone people must adopt, and I believe they have eagerly grabbed for it. The reason is understandable, for it is a philosophy of the spirit. It feeds the soul. It is what we have called in the past the spirit of service. Maybe in detail it is different—I do not know. But it means we are working not just for money, nor to increase sales, nor to meet demand, nor to increase profits—but to serve and be a contributor to an ever-growing, ever-better country. This is a goal that does and will excite people.

Faith in ourselves, in our ideals, and in our country has in the past inspired our noblest and best actions. We must keep that faith.

An editorial statement

THE "CONSENT JUDGMENT"

Note: For seven years, the antitrust suit brought by the U. S. Attorney General in 1949 against the A. T. & T. Co. and the Western Electric Company has been of concern to Bell System people everywhere. The following statement sums up in layman's language the more important consequences of the consent judgment which was agreed to last January and which enables the A. T. & T. Co. and Western Electric to go on about their primary and vital business of providing communications services for the nation. EDITOR.

ON JANUARY 24, 1956, Judge Thomas F. Meaney of the U. S. District Court in Newark, New Jersey, signed a consent judgment submitted to him jointly by attorneys of the Department of Justice, the American Telephone and Telegraph Company, and the Western Electric Company. This act brought to an end the antitrust suit instituted by the Government against the companies on January 14, 1949.

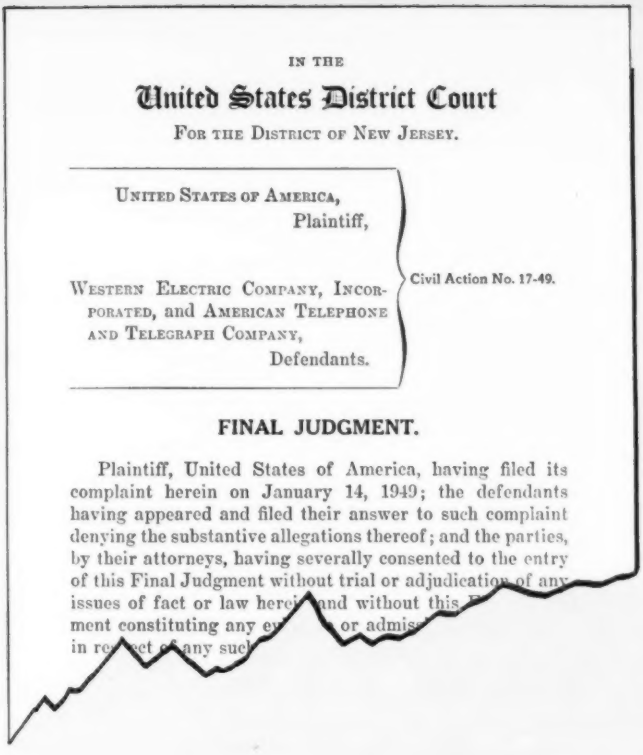
The judgment's terms, which were the result of negotiations between the Government and the companies, constituted a compromise settlement of the suit, rendering unnecessary a court trial which would doubtless have been prolonged and very expensive to both sides.

The Government's seven-year-old complaint alleged that A. T. & T. and Western had illegally monopolized the production and sale of telephone equipment and supplies. It sought to separate Western from the Bell System, to dissolve Western into three completely separate companies, and to require the Bell operating companies to buy all equipment and supplies under competitive bidding.

At the time the complaint was filed, A. T. & T. and Western expressed the belief that the Government's charges were without foundation, and stated their conviction that the existing relationships and arrangements among System companies were of the highest value to the telephone-using public.

The work of complying with subsequent requirements of the Government for documents from the files of A. T. & T., Western, and Bell Telephone Laboratories was an enormous task. By June 30, 1953, when all orders and requests for documents had been met, there had been shipped to the Department of Justice ten copies each of some 70,000 pages of material, weighing about two tons. Hundreds of employees devoted all or part of their time to this and other phases of the case. Had the suit gone to trial, however, the demands upon personnel at all levels of the companies would have been far greater—possibly to the point of impairing the ability of the three companies to carry on their regular functions.

The fact that A. T. & T. and Western agreed to the terms of the judgment does



IN THE

United States District Court

FOR THE DISTRICT OF NEW JERSEY.

UNITED STATES OF AMERICA,
Plaintiff,

WESTERN ELECTRIC COMPANY, INCORPORATED, and AMERICAN TELEPHONE AND TELEGRAPH COMPANY,
Defendants.

Civil Action No. 17-49.

FINAL JUDGMENT.

Plaintiff, United States of America, having filed its complaint herein on January 14, 1949; the defendants having appeared and filed their answer to such complaint denying the substantive allegations thereof; and the parties, by their attorneys, having severally consented to the entry of this Final Judgment without trial or adjudication of any issues of fact or law here[illegible] and without this F[illegible]ment constituting any ev[illegible] or admis[illegible] in re[illegible]ect of any such

not mean that they were found guilty of, or admitted, any of the charges contained in the complaint. The Court merely concurred in and confirmed the agreements reached between the Government and the companies in accordance with which both sides were willing to settle the case.

Underlying the judgment is a recognition by the Government that existing regulatory processes adequately protect the public in the furnishing of regulated communications services and the manufacture of equipment by Western for use in such services. The long-standing relationships among the manufacturing, research, and operating organizations of the Bell System --so essential to efficient and progressive telephone service--remain intact.

The judgment provides that the operating companies of the System shall not engage in any unregulated activities (unless such activities would be regulated if they were of an interstate character) and that Western shall be confined to the kind of manufacturing and other activities in which it engages for the System. The System is not prohibited, however, from manufacturing any equipment or providing any services for the Government, and it may continue to provide advice, assistance, and circuit facilities to other communications carriers. The directory advertising business and other activities incidental to the furnishing of regulated communications services may also be continued.

The judgment requires A. T. & T. and Western to grant licenses to anyone under any of their existing or future U. S. patents. Virtually all U. S. patents issued prior to the date of the judgment are to be licensed

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royalty-free. Patents issued subsequent to the date of the judgment are to be licensed at reasonable royalties. A. T. & T. and Western are not required, however, to grant any patent license unless the licensee grants to the System any licenses the latter wants for use in its regulated communications business, subject to reasonable royalties. Since it has been the policy of the System to grant licenses under any of its patents to anyone for any purpose on reasonable terms, the principal effects of these provisions of the judgment on the System are to make this policy mandatory and to require royalty-free licensing under U. S. patents issued prior to January 24, 1956.

An exception was made as to licensing arrangements with General Electric Company, Radio Corporation of America, and Westinghouse Electric Corporation. These companies, together with A. T. & T. and Western, have been parties to a patent licensing arrangement that was criticized in the Government's complaint. The judgment does not require licenses to these companies under existing patents to be royalty-free unless these companies are willing, in turn, to grant similar royalty-free licenses to the System.

Upon request, A. T. & T. and Western are required to make available to patent licensees (but only those domiciled in the U. S. and not controlled by foreign interests) certain technical information associated with the licensed patents. This information, for which reasonable charges may be made, is to consist of manufacturing drawings and specifications relating to products Western makes for the System.

As a result of these principal provisions of the judgment, Western expects to dispose of Westrex Corporation, a subsidiary that furnishes sound recording equipment in the U. S. and also sells theater equipment and other items abroad; and the System must discontinue the rendering of certain communications services now furnished on a private contract basis, but only to the extent that these services are not, or do not become, subject to public regulation. So far as can be foreseen, the judgment will not impair in any significant way the Bell System's ability to carry on its public service undertakings or continue its important contributions to national defense.

In commenting on the settlement, President Craig said:

"During the seven years since this suit was brought, the Bell System has furnished the Government with extensive information. While the terms of this decree are stringent, they do recognize the position we have held from the beginning that supervision by Federal and State regulatory bodies safeguards the public interest. We believe the long-standing relationships among the manufacturing, research, and operating functions of the Bell System are in the public interest, and under the decree they remain intact. To a very large extent, it is the unique combination and teamwork of the operating companies, the Bell Telephone Laboratories, and the Western Electric Company that, over the years, has produced for the people of this country the finest, most widely used and progressive telephone service in the world."

Opportunities for growth and expansion and evolution in telephone service through invention and development of new devices are greater now than ever before

A SCIENTIST LOOKS AT THE FUTURE OF THIS BUSINESS

RALPH BOWN
*Vice President,** BELL TELEPHONE LABORATORIES

Note: The following is the substance of a talk which Mr. Bown had given to groups of Bell System executives before he retired* on February 29, 1956. EDITOR.

WHEN I GO OUT in the laboratory and talk to the people who are working out there, and when I talk with the boys at lunch, I find they are discussing things that are quite foreign to the things I used to know about when I worked in the laboratory; stranger things even than the ones I used to know about when I was closely involved in the technical work just a couple of years ago. It isn't exactly a foreign language. It's more like a high-school boy getting into college. Somehow, he just feels out of place, as though everything is over his head. I feel as though I ought to go back to school if I'm going to keep up with this gang.

But when I go back to the office and sit down and put my feet up on the desk and begin to think about it from another angle, it looks different. It's sort of like when you go into a movie theater in the middle of the show. You watch it going on as gradually the theme develops. Finally you come to the end and it starts over again. Pretty soon, all of a sudden, things look familiar and you realize this is where you came in. It sort of looks to me like that as I sit at the desk: *this is about where I came in.*

Well, I'd like to talk to you a little bit this morning about how those two points of view, which on the surface seem so divergent, really both fit the circumstances and are not incompatible at all.

If I go back to the time when I came to work—and old-timers of course are supposed to talk about that time (which to be exact was in 1919)—if I look upon it now with what has been referred to as the exquisite precision of hindsight, I can see that at that time we had just come into possession of two very important and now very clear things. I don't suppose at that time we realized it in quite the terms that we do today, but it's quite clear today that we then had in hand two new

and fundamental tools which were to become very important in the communication business. One of these tools was the electronic vacuum tube, and the other was the theory of modulation.

I DON'T NEED to tell you what the electronic vacuum tube is—or was, rather. At that day, it was a very simple little three-element tube. Nor do I need to tell you what it has done. You know that it has supplied the means whereby communication has become a part of our lives. It was the first device which could put out more electricity than you put in, at an extremely high speed and with minute amounts of input energy.

The significance of the theory of modulation may not be quite so familiar to you. The theory of modulation was relatively new at that time—in fact, there was still some controversy as to whether there were such things as sidebands. The theory of modulation taught us how to pick out a communication package, such as a telephone band, and move it any place we wanted to in the frequency scale. It's the basis on which we made our carrier systems, it's the basis on which we have radio telephony, the basis on which we have the broad band systems in which we put hundreds of channels together. It is even in some respects the basis of television, because in television we use the single-sideband method of transmission which was first evolved for use in carrier and transatlantic telephony.

Now what those two things, the vacuum tube and modulation, have done to the world is just as familiar to you as it is to me: voice frequency repeating in the telephone business, and carrier. Then came radio broadcasting, transoceanic telephony, program networks, broad band

This first demonstration of radiotelephony linking an airplane in flight with the ground, at Langley Field, Va., in July 1917, employs equipment developed by the laboratories of the Bell System and manufactured by Western Electric. Dr. Bown, then a captain in the Signal Corps, is second from left.

This photograph of the opening of New York-London radio telephone service in 1927 shows in the front row from left to right F. B. Jewett, J. J. Carty, W. S. Gifford, Bancroft Gherardi, and E. B. Craft, A. T. & T. and Bell Laboratories officials of nearly 30 years ago. It was this single sideband radio system which provided the first commercial telephone link between the United States and Europe.

coaxial, and finally television and all the other electronic things we have today. It's the proliferation of the various forms of the electronic vacuum tube and the variety of applications of the theory of modulation which brought those things about.

Television is not quite in the pattern that I'm trying to draw for you here, and of course no pattern is exact enough to include everything. There were other elements in television than simply vacuum tubes and the theory of modulation. But I'll have a little more to say about television in a few minutes.

So MUCH for what has gone before.

How do things look as we stand today? If we could move off twenty or thirty years hence, and look back at the present time with the same kind of eye with which one can now look at 1920, what would we see?

As I try to do this, I see a scene which seems familiar. I see a situation in which we have again just fallen heir to two very potent and fundamental things. Again, one is a device and the other is a principle. The device is the transistor, and the principle is called information theory. Let's just enlarge on those a little.

The transistor isn't quite as familiar to you as the vacuum tube, and its portent may not be evident. The significant thing about the transistor is not that it's tiny, although that's important, nor that it's made out of solid material. In some respects that simplifies it but in other respects it complicates the construction. The really significant thing about the transistor is that it can operate with very minute amounts of power. It can operate efficiently down at extremely low power levels. It takes only a little more power to make it work than the power it gives out.

One of the seven radio relay towers in the micro-wave system between Boston and New York—the first link in today's transcontinental radio relay system. This broad band system is one of the many radio telephone systems made possible by the application of high frequency techniques.

This is radically different from the vacuum tube. You have to put quite a little power into a vacuum tube to make it work at all, even though you're going to do only the minutest jobs with it. So here we have a device, for the first time, which is able to operate efficiently down at the low levels of power which are the essential levels in communication circuits. If you look at communication circuits in general, you'll find that voice currents need only small fractions of a watt. Where we have more power than that in our telephone circuits, it's for other purposes or for other reasons, such as ringing or supervision. If we could get rid of the old methods, we would simplify many of our problems.

The transistor permits us to do this. It looks to transmission engineers as though the efficiency of the device, combined with its other characteristics, and combined with the miniature devices which have been derived from the companion art or which have been devised to go with it, will enable them to go into the local plant of the telephone system and bring about a revolution like that which occurred in the toll plant when the vacuum tube entered it. We will be able to operate at low power levels, to put gain wherever we wish to, to operate oscillators efficiently, and to do other things. Here is the prospect of a very considerable technological change, and as far as I can see the telephone company sits right in the middle of it.

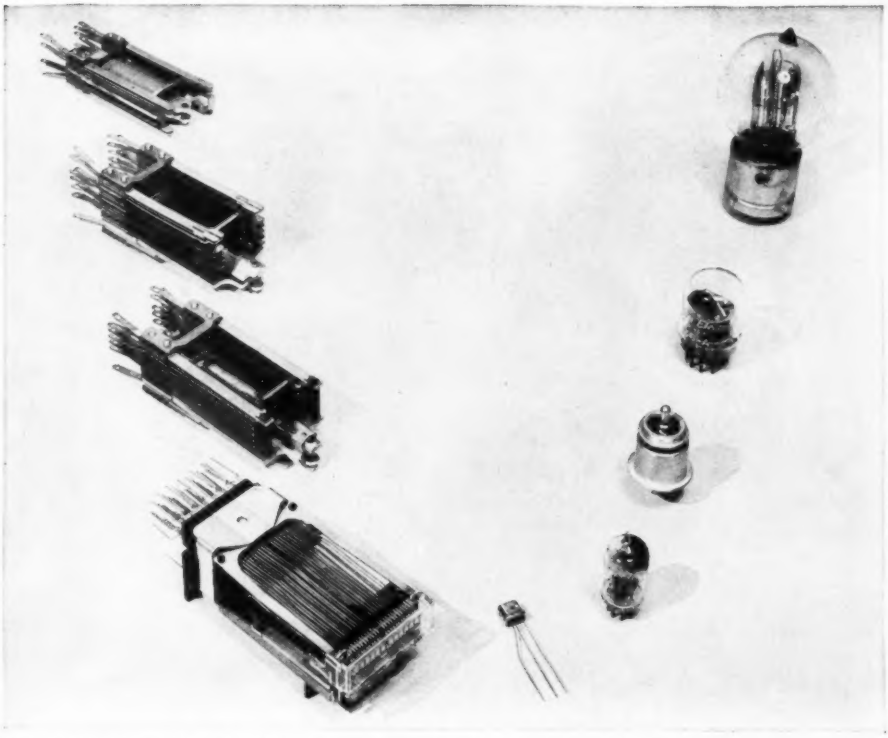
NOW LET'S THINK A LITTLE about information theory.

Information theory is something which I can't explain to you. I'm not sure anyone in this room can tell you very much about it. When you get into its details it is a very abstruse and involved mathematical concept. Nevertheless, in its essentials it is a simple thing. A way has been discovered of measuring communication quantitatively; a way of expressing the amount of information which you communicate through any kind of communication system from a speaking tube to a television system, in quantitative terms so you can use it in calculations. You can put band width, amount of communication, efficiency, noise, and power—all those things —into equations which you can juggle around to arrive at the best solutions to engineering problems. You can arrive at design compromises between these things to get the best economic balances, and do things engineers couldn't do before.

There are certain other concepts which flow from this new knowledge, or at least we have come to understand them better

through it. We know, for example, that you can take any kind of knowledge transmission, any kind of transfer of knowledge from me to you or from you to me, and express it in terms of a string of pulses. Now this is just like saying that you can take any form of information and turn it into a telegraph message, and that's exactly what I mean. You can take a voice wave, of the ordinary kind, for example, and express it by attaching an evaluating number to each individual point along the curve as it changes with time. Expressing those numbers in a telegraph code, you can transfer the whole thing into a synthetic telegraph message. You can send that telegraph message just as fast as you can send the speech, and then in a flash decode it and turn it back into speech.

This is the kind of thing which we now call PCM or Pulse Code Modulation. That's all it is. It is turning any kind of message you want, any kind of flow of knowledge, into a telegraph message and sending it over a circuit and then getting it back again. When you send that kind of message over a circuit, you can send it perfectly. We can set up telegraph circuits so that there are no errors. We can set them up so that we have regenerative repeating and thus we can repeat over circuits as long as you like.



A junction transistor in the center foreground is contrasted with a series of relays and vacuum tubes used in telephone operations.

SOME TIME AGO, there was a mathematician who expounded the principle that any mental process which can be reduced to a rule or a law and stipulated can be mechanized. Now that covers a lot of territory. It certainly covers a tremendous amount of routine human work, mental routine work, a large part of it drudgery.

What is it going to mean to us to have mechanization of this kind? I think we can imagine if we just remember what has happened in the utilization of power machinery for relieving man's muscles of labor. When I was a boy, I remember that a high speed inter-urban railway was built that went right through the little town that I lived in. It cut across the back lot behind our house and curved against a hill so that a little piece of that hill had to be taken away. It wasn't a very big piece; probably all the soil involved could be put into a fair-sized barn. Well, for weeks and weeks there was a string of dump wagons with horses and gangs of men with picks and shovels working away at that hill, and gradually they made the little cut.

The amount of soil which was moved to build this building where we are was many times as much. It was done by just a few men with great big earth moving machines, and no one thought anything of it. We simply could not do in those days the kind of physical things that we now do as a matter of course. It may very well be that, with the so-called digital computing machines that can carry out routine mental operations, man will be

Closed-circuit television is becoming increasingly important in business and industry. Here an operator is watching on the screen the progress of a steel strip in a hot strip steel mill. The camera scans a distance of 395 feet.

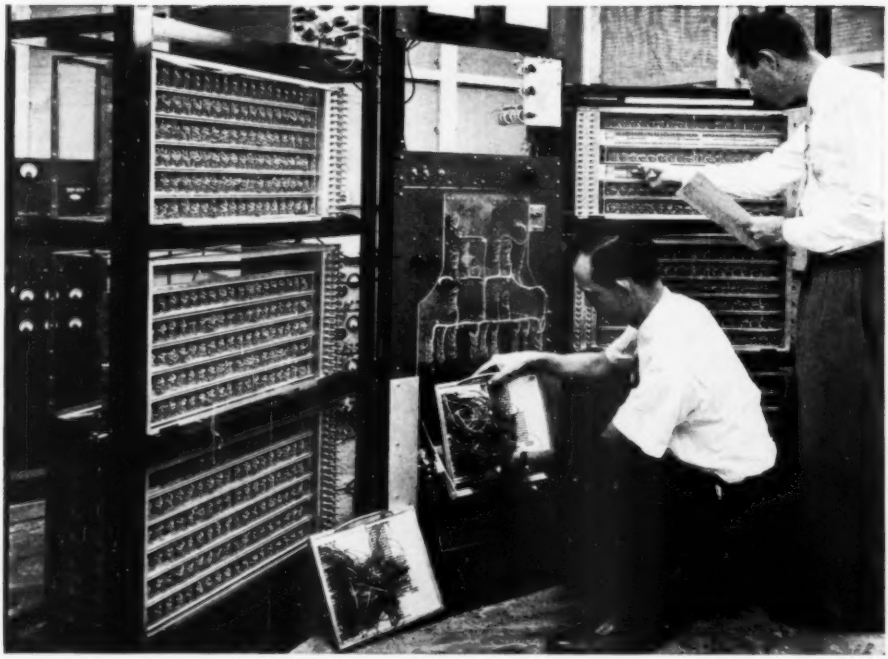
able to do drudgery of a quantity and kind that he never could possibly afford to do with human beings. This may revolutionize things quite a bit.

As these machines become more and more prevalent, as we depend more and more upon them, what are we going to find? They talk a language of electronics, a language of pulses, and they have in their heads memories in which they store these things. Their whole existence is based on remembering things and using things in terms of electronics. They don't think in terms of pencils and paper or decimal numbers or typewriters or anything like that—they think just in terms of electronic pulses. And they have to communicate with each other—one machine has to dump its product into another just the way human beings have to pass their work on from one to another. They have to be departmentalized. And just as we don't transport oil any more in tank cars but send it in pipe lines, so it seems very likely that information in electronic language will not be transmitted by mail, on paper. It probably will be transmitted in electric pipe lines, and those electric pipe lines fit right in the middle of the telephone business.

I SAID A MOMENT AGO that television didn't quite fall into the pattern of things that I was making, and I'd like now to say a word about television, because this it seems to me is another thing which looms large in the future. Television we have seen so far only in one form. We have seen it in the form which is adapted to mass amusement. But as time goes on we are going to find out that the ability to see at a distance, to look over a wire anywhere, any time we want to, for any purpose, is something which will very gradually but very certainly affect our lives.

An electron beam-coding tube used in early tests of pulse code modulation systems at Bell Laboratories. In PCM systems any kind of message, whether a voice signal or a television picture, can be reduced to telegraphic form, sent out over a circuit, and then reconstructed without error at the receiving end.

If you stop to think how the telephone affects your life today, it's pretty difficut to encompass it. There's hardly a move you make today that isn't conditioned in one way or another by something you've done with the telephone or something which has depended on your automobile.



Tradic, *a new digital computer developed at Bell Laboratories, contains nearly 800 transistors and 11,000 germanium diodes.*

Between those two things, we have completely modified our way of life. We have absorbed them. They have become part of our habits, part of our customs. If we could have visual communication in that same way, with its great capability of conveying information, it also would, gradually and over a period of time, modify our customs and our habits. At present we think too narrowly about this. We say "I wouldn't want a television in my house so that anybody could call me up and look at me, maybe working in the kitchen with my hair down." People talked that way about the telephone originally. People thought they didn't want to be invaded by the telephone, but they are. When the bell rings, everybody in the house jumps and runs for it, and they think nothing of it. Our whole habit of life has changed to fit it because we want to make use of its capabilities.

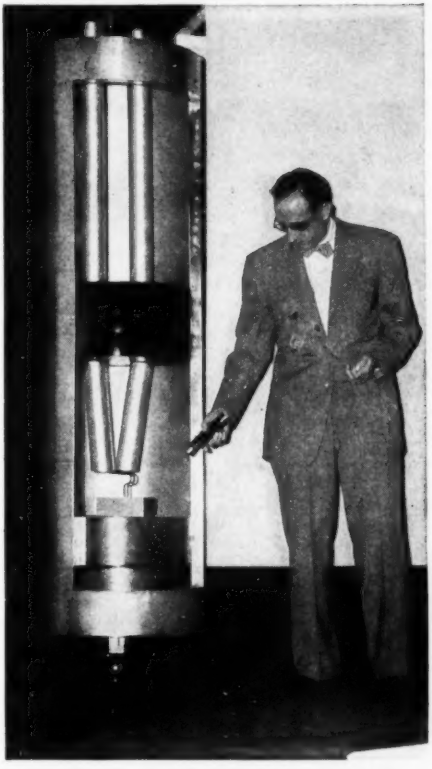
This same sort of thing is going to happen ultimately with visual communication. I would think, myself, that its use in the home and for social purposes will be perhaps the last part of the evolution rather than the first part. The first part is coming in terms of industrial uses, educational uses, and similar utilitarian purposes. But I think surely it is coming.

Now the telephone company sits right in the middle of that situation too, and we aren't sitting very pretty as yet, because one of the things which is necessary to bring about this change, this evolution,

is the ability to deliver, cheaply, anywhere, all the circuits that anybody wants for visual purposes—the ability to go into any place and connect with television terminal apparatus just the way you go in with a drop wire now and install a telephone. We don't have the facility for doing that now.

The Laboratories has been working very actively for several years on finding ways in which we can do it economically, trying to develop a kind of plant which will be capable of growth and expansion to take care of that sort of future. I'm sure they are going to do it. In fact, they already have methods whereby it could be done, but I'm sure they are going to have better methods.

NOW LET ME CIRCLE BACK to where I began. I hope it is a little clearer to you why it looks to me as though my education needs to be modernized if I'm going to be able to keep up with the procession. And yet, at the same time, it's the old familiar scene: the opportunities for growth and expansion and evolution in the telephone business are greater than they ever were before.



At the press demonstration in 1948 at which the invention of the transistor was announced, Dr. Bown explained its characteristics and operation by means of a greatly enlarged cut-away model of the point contact transistor.

The Advanced Bell System Executive Conference carries forward at higher levels the broad-gauge undertaking embarked upon originally in 1953

A UNIQUE ADVENTURE IN EXECUTIVE DEVELOPMENT

MELVIN ANSHEN

Professor of Industrial Administration, GRADUATE SCHOOL OF INDUSTRIAL ADMINISTRATION, CARNEGIE INSTITUTE OF TECHNOLOGY

MANAGEMENT TALENT is the most important and the scarcest resource in the United States. Every company must be concerned with preparing its executives to deal with the critical problems of dynamic growth and change. Equally important, business must plan in advance the development of the pool of management talent required to direct expanded operations and to replace officers who retire.

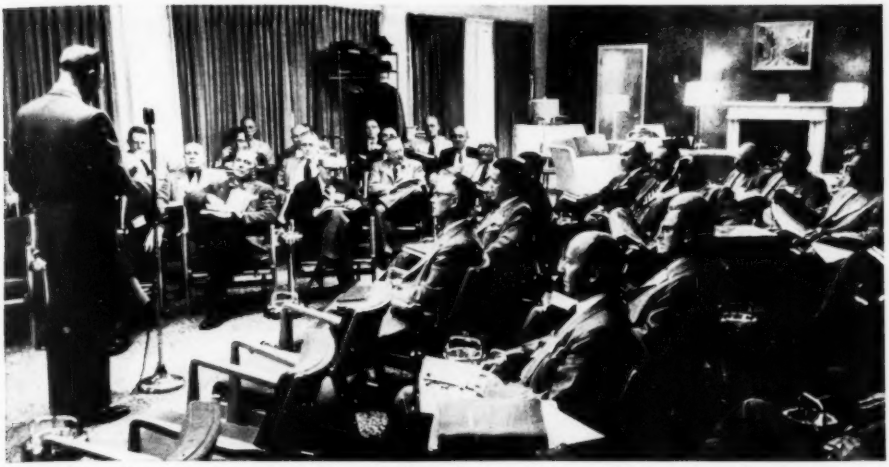
Bell System companies have been among the leaders in their concern about finding and developing management talent. Over the years they have pioneered in advancing executives' command of both the technical requirements of their assignments and the administrative skills necessary for effective organization and leadership.

With the inauguration of the Bell System Executive Conference in November 1953, the System companies undertook another pioneering advance in executive development. This was the first large-scale effort by a single corporate enterprise to broaden the thinking of a complete horizontal slice of management personnel throughout the organization Since that time, other companies have initiated comparable programs, building in part on Bell System experience.

In the fall of 1955 another step forward --again a pioneering advance--was made with the opening of the Advanced Bell System Executive Conference program, designed for men who had participated in the basic course. The significance of this undertaking, its objectives and the methods adopted for their realization, and its anticipated long-run value for the industry can best be appraised against the background of the basic BSEC program.

The Basic BSEC Program

THE DEVELOPMENT of executives beyond high competence in the specific technique and skill requirements of their functional assignments was not a new interest for Bell System companies in 1953. Many telephone companies had sent executives



Assembly: The entire group gathers daily to hear and to take part in a discussion of a current topic, led by an outstanding Bell System man or by an outside authority.

to advanced management courses sponsored by universities. While these courses had been found valuable, they could accommodate only a small number of Bell System people. Most university programs aim at enrolling a diversified group of executives from a broad range of industries, and will accept no more than one or two men from a single company. It was clear that only by creating its own course could the System meet its need for preparing a large number of executives to deal with many of the problems raised by the enormously expanded demand for telephone service, as well as by the technical, social, and economic changes that are taking place in the world.

The problem of how to provide background training for a large number of telephone management people was turned over to the following committee of vice presidents of Bell System Associated Companies:

F. A. Cosgrove, New England Telephone and Telegraph Company, *Chairman*

J M. Black, Southwestern Bell Telephone Company

R. E. Driver, Michigan Bell Telephone Company

W. G. Hampton, New York Telephone Company

F. G. Macarow, The Chesapeake and Potomac Telephone Companies

F. M. Malone, Southern Bell Telephone and Telegraph Company

J. N. Stanbery, Illinois Bell Telephone Company

R. K. Greenleaf, Staff Assistant, Personnel, A. T. & T. Co., acted as secretary for the committee. A staff composed of men from System companies and several outside consultants was organized to aid the committee. The late Herbert L. Deal, Assistant Vice President, Personnel, A. T. & T. Co., served as Director of BSEC in 1953 and 1954. He was succeeded as Director of BSEC in 1954 by Charles W. Potter, Assistant Vice President, Personnel, A. T. & T. Co.

Systematic surveys of university advanced management programs and the

executive development courses conducted by the American Management Association and other business groups were combined with non-directive interviews with Bell System officers, general managers, and department heads to determine the development needs of telephone managers and the content and method of the planned program.

The course was designed to serve three basic development needs:

(1) to broaden the thinking and the outlook of telephone management people;

(2) to increase their present effectiveness; and,

(3) to stimulate their interest in further self-development.

The acceptance of these needs as the focus of interest reflected general recognition that Bell System executives already possessed high technical competence. Throughout the System there was agreement that the critical requirement was to open mental windows for men who had spent their business lives within the telephone industry, frequently within a single department in a single company.

The exploratory interviews suggested the importance of adding to executives' understanding of how the American economy operates, the causes and effects of secular and cyclical changes in levels of business activity, the causes and techniques for control of inflation and deflation, and how the behavior of the national economy affects the telephone industry. There was wide expression of a desire to know more about how companies in other industries deal with problems they share in common with the telephone business.

THE BELL SYSTEM EXECUTIVE CONFERENCE was planned to serve these basic development needs. It was established as a four-week program located at Asbury Park, N. J., away from company offices and the distractions of a large-city environment. About forty people of department-head level attended each session in 1954 and 1955. Each group was diversified in terms

Round table: Opinions are voiced freely and viewpoints are debated.

of companies and administrative functions represented.

Operation and behavior of the national economy, handling of common problems by companies in other industries, and broad telephone policy issues were the subjects given principal attention in the curriculum. Extensive use was made of cases and concrete problems, although lecture-and-discussion sessions were an important part of the program. Great emphasis was placed on round-table discussions in small groups, with members of the BSEC staff serving as discussion leaders. Cases and problem materials were drawn from outside sources, as well as from the experience of Bell System companies. Participants did extensive background reading in preparation for discussions, and suggested supplementary reading material was sent to the men after they returned to their homes.

From November 1953 to June 1955 a total of more than 700 executives of department-head level and some general managers attended BSEC. Participation was voluntary, but final selection for a specific session was necessarily influenced by an individual's availability as determined by circumstances in his own organization and by the BSEC goal of assuring maximum diversification of background and experience within each group.

THE PROBLEM of how to evaluate the results of executive development courses in terms of what they do for participants has yet to be solved by any of the existing programs, whether under university, trade association, or company sponsorship. Research is in progress on the application of psychological testing and measuring techniques to the evaluation of progress in executive development. The only appraisal techniques currently applied in practice, however, are the familiar ones of informal querying of participants and a sensitive listening-post for feed-back reports.

Receptive attentiveness characterizes the attitude of the men who come from all parts of the Bell System to take part in the "post graduate" course at Asbury Park.

By these latter measures the Bell System Executive Conference has been outstandingly successful. It is popular with the men who attend. They report that they leave Asbury Park with a recognition that their intellectual outlook has been broadened. They acknowledge that many pet prejudices have been jolted from their foundations. The attitude of top Bell System officers is reflected in Mr. Craig's statement:

"There is no teacher-to-pupil instruction in the usual sense; no preaching. There is no asking or advising the conferees to 'think and act in the interest of the community.' But does the give-and-take of minds help to broaden viewpoints? Does it stimulate new insights—give a man a better understanding of the relation between his job and the world around him?

I can't help but think it does. And those who are taking part seem to think so too."

The record has been so favorable that the decision has been made to schedule a small number of sessions in 1956 to accommodate the few department heads who were unable to attend during the first two years and the larger number of men who have been promoted to positions at this level since the program started. In addition, a number of System companies have started or are planning programs for men at the division and district levels. These programs are based upon a study of the needs of men at these levels just as the basic BSEC program was based upon a study of the needs of men at the department head level.

This favorable reaction does not mean that those responsible for planning and administering BSEC have been unaware of possible weaknesses in the course. It has been recognized from the outset that a single-company program may sometimes fail to provide the kind of opportunity and challenge that can be presented in a university program which assembles men from a variety of companies with diversified industrial and functional backgrounds. This potential deficiency is remedied in part in BSEC by the practice of inviting speakers and discussion leaders from outside the Bell System. Some have felt that this lack of diversity in viewpoint may be particularly important for the telephone organization, with its tradition of long employment service and its up-from-the-ranks policy in filling management positions.

On the other hand, it must be recognized that the Bell System resembles an industry more than it does a single company. There is a wide range of outlook among the members of a typical Asbury Park group which includes line and staff men from operating telephone companies in all parts of the country; manufacturing, installation, and distribution managers from Western Electric; and technical and staff administrators from Bell Telephone Laboratories.

The Advanced Program

THE DECISION to undertake an *advanced* BSEC program reflected a fundamental belief that education is a process that never ends. It also reflected the view of top telephone officials that the maximum value of the broader intellectual horizons

Notes are important . . .

Ideas are exchanged . . .

stimulated by the basic course could be realized only if this new outlook could be brought to bear on current and anticipated management problems in the Bell System.

After studying the viewpoints of many men who had attended the basic course, the Executive Committee for BSEC* concluded that the best way to accomplish this objective would be to plan a series of conferences for people of department-head level about two years after they attended the basic BSEC program. It was also decided that it would be advantageous to invite men at the general manager and higher levels to attend.

The primary objective of the Advanced BSEC program is to put the participant in the position of the general officer of a telephone company. He is given an opportunity to evaluate broad economic and social trends and to form judgments about how they affect the telephone business. In the setting of a general telephone operating problem, he is faced with the necessity for appraising both short- and long-term issues confronting top management, for determining objectives, and for formulating plans and programs to meet these

Composed of the officers responsible for planning the basic course in 1953, with the addition of F. D. Tellwright, Pacific Telephone and Telegraph Co.

Content of Advanced BSEC

THE CONTENT of Advanced BSEC includes the following topics:

Problems in the Use of Capital. Here participants have an opportunity to study how long- and short-term capital requirements are determined in industries other than the telephone business, and how these requirements are met. This includes problems related to the appraisal of current and anticipated economic conditions, the assessment of financial conditions in specific companies, the adequacy of earnings, sales forecasting, capital budgeting, and the sources and cost of capital.

Merchandising and Marketing. Under this topic participants study merchandising and marketing programs in several different industries such as retailing, consumer appliances, and producers' heavy equipment. Subjects covered include: analyzing markets and future demand, creation and stimulation of demand through advertising and salesmanship, and the integration of sales with procurement, inventory control, and production scheduling.

What's for lunch? . . .

It's serious business . . .

The "All Work and No Play" atmosphere is carefully avoided.

Fresh approach.

Recent Trends in Labor Relations. The work in this area covers trends and factors that appear significant in the field of union-management relationships.

Business-Community Relationships. This part of the course gives the men an opportunity to consider society's attitude toward business, and conflicts between industry and community interests.

Human Relations. This part of the program is directed toward exploring such issues as communications within business organizations and between organizations and the outside world, motivating people to do their jobs, and group relationships.

All this work serves as general background and preparation for the assignment which is the climax of the course: a long, involved, and comprehensive general-management problem in the telephone business. A fictitious telephone company—"Median Telephone Company"—has been created by assembling actual data for selected areas in a number of Bell System companies. This compendium of statistical material, covering all phases of operations, the economic and social environment that surrounds the company, and the regulatory climate in which it functions, is presented in full detail, extending to more than 65 pages. The case also contains reports of problem-oriented interviews—based on actual interviews with anonymous persons in a number of System companies—with officers and management personnel at all levels.

The assignment to participants is made in the following terms:

"Review and study the performance of the Median Telephone Company, the interviews with its management people, and the company's future prospects with the following questions in mind—

"1. What is your appraisal of the company's present situation?

"2. What recommendations would you make for the company's future operations both short- and long-term?"

The assignment asks participants to appraise the situation facing Median's management, select those problems or issues that should command the attention of the

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general manager and his associates, and decide what should be done and how to do it. In carrying out this assignment the men find opportunities to evaluate current and future economic conditions nationally and in the territory served by Median, study the service and cost situation, determine services and facilities requiring sales emphasis, decide on expansion programs and the availability of capital for financing them, determine revenue and pricing policies in view of the earnings situation, consider future bargaining policies and their impact on earnings, and review and plan for community relationships.

The general method that proved successful in the Basic BSEC program has been retained in the advanced course. The program runs for two 5½-day weeks. The enrollment in each two-week session is limited to about forty men. Most of the participants are people of department-head level who attended Basic BSEC from eighteen months to two years earlier, but each session also includes some officers and general managers. The planned diversification of company and departmental background that contributed to the effectiveness of the basic course is repeated in the advanced program.

Group discussion of problems and cases, based on background reading and study of case and problem material, remains the principal educational technique. A change of pace is introduced by lecture-and-dis-

cussion sessions with speakers drawn from a number of business and other areas outside the telephone industry. One interesting change from the method followed in the basic course is in the leadership of the small-group discussions. In Basic BSEC, members of the conference staff served as discussion leaders. In Advanced BSEC, the responsibility for leading the analytical sessions is carried by the participants, who rotate the assignment.

An unusual schedule has been established for handling the involved Median Telephone Company case. The extensive statistical material in this case is sent to participants before their trip to Asbury Park. After they arrive, they receive the interview material. The men analyze the case in several informal small-group meetings. The last two days of the two-week program are given over almost entirely to the Median case. Participants spend about six hours in two sessions with a discussion leader from outside the Bell System, reviewing and defining the Median Company's situation.

The objective is to select major issues that should be of principal concern to management and to put together a comprehensive program of recommendations for dealing with these issues. These two periods are followed by a third session in which an officer of one of the System companies, who has listened to the preceding discussion, presents *his* views of Median's situation and *his* idea of an ap-

propriate course of action. This leads to further discussion in which the appraisals of participants and leader are compared and differences in views are explored.

Appraisal of Advanced BSEC

ADVANCED BSEC is a unique adventure in executive development. Those responsible for planning and directing its operation are keenly aware of the pioneering aspect of their undertaking. Every session sees at least minor changes in content and method, introduced after study of the reactions of participants in earlier sessions and the critical reports of observers from within and outside the Bell System.

What the ultimate value of Advanced BSEC may be it is impossible to forecast at this time. Appraisals by participants in early sessions are strongly favorable. The men report challenge and stimulation, a return that justifies the investment in time and money. But the real worth of such a course is the record of management performance in the Bell System over the next decade.

The opportunities and the difficulties that face American business management in the years ahead may well provide the most critical test of our ability to survive as a free society. Broad, imaginative, and creative thinking will be called for from all who share responsibility for administering economic resources and organizing the efforts of people. If BSEC helps to assure this kind of approach to management problems in the telephone industry, it will repay its investment many times over.

Out to lunch.

Pacific Company rises to the challenge as winter floods bring a calamity which is regarded as the worst since the San Francisco earthquake and fire of 1906

PACIFIC COAST IS HIT BY DISASTROUS STORMS

M. K. JORDAN

Editorial Associate, THE PACIFIC TELEPHONE AND TELEGRAPH COMPANY

EVERY WINTER brings its storms out of the vastness of the Pacific Ocean and hurls them against the western edges of North America.

Typically, say the meteorologists of the U. S. Weather Bureau, the West Coast's storms originate in the Western Pacific off the coast of Japan, around the 30th and 40th parallels of latitude.

They move eastward with the prevailing winds. As each storm center nears the continent, it usually begins to veer off on a northeastward or occasionally due northward course. Thus the traditionally stormy coast lines of British Columbia, southeastern Alaska, and Washington State most often feel the full force of winds up to 70 miles an hour accompanied by drenching rains. Only the fringes of these winter storms ordinarily reach Oregon and Northern California.

But the pattern was disastrously broken by a series of storms that struck Northern California and parts of Oregon and Washington from December 18 to 25, 1955.

Earlier storms, following the customary northeastward curve, had left heavy snowfalls on mountain ranges of the Pacific Coast before December 18. Below the snow line and in the valleys, the soil was already rain-soaked.

Then, out of the Pacific on December 18 came the first storm, a nameless rebel that failed to swing off to the north. Instead, it moved due east, and the storm's center crossed the coast near the California-Oregon line. For hundreds of miles north and south of that point, the storm's strength was felt.

For the second time since the completion of Pacific Telephone's headquarters building in San Francisco in 1925, whole gale warnings whipped from the signal mast on the 27th floor. Wind velocities reached 100 miles an hour on coastal mountain tops. Rainfall was heavy, but not disastrous.

Scarcely had a secondary disturbance, following the first, passed over on December 19 when a new storm sequence struck. Originating in the central Pacific west of the Hawaiian Islands, these were warm, semi-tropic rains. One storm center after another roared inland across Northern

California and Southern Oregon on December 20, 21, 22 and 23. Deluges of warm rain fell on the lowlands and up to the 9,000-foot level in the mountains.

Rainfall for the five-day period totaled 30 to 40 inches on many watersheds. Melting snow multiplied the run-off as rivulets fed creeks that fed rivers. From the south end of California's great central valley northward 700 miles to the Columbia River, scores of swollen torrents rushed toward the sea.

The muddy water gushed through homes and businesses in dozens of communities, debris-battered bridges collapsed and whirled downstream, roads were undermined or blocked by huge landslides. Hundreds of persons owe their lives to helicopter rescues that plucked them from treetops or rooftops. Thousands fled their homes to spend Christmas Eve and Christmas Day in refugee shelters.

THE SAME RAMPAGING RIVERS that destroyed sections of highway and railroad sucked the earth away from pole lines and toppled them. As bridges and levees crumbled from pounding water and debris, telephone cables snapped. Landslides carried away buried cable and poles. Flood water burst into central offices and repeater stations.

There were 83 telephone central offices in Northern California, Nevada, Oregon, and Washington-Idaho temporarily without inter-toll switching network service at one time or another during the emergency. There were long distance failures involving more than 3,000 message circuits, 96 private line telephone circuits, 50 voice

This is one of two breaks in a levee at Rio Oso, California, that interrupted service over the main north-south cable route on the Pacific Coast. Temporary cable is already up. Washed out track at left is main line of the Western Pacific Railroad.

frequency telegraph systems, and 44 program circuits. At the storm's worst, about 30,000 telephones were out of service. The cost of rehabilitation and maintaining service for the hardest-hit operating area, Northern California, has been placed at about $4,500,000.

It is further testimony to the sturdiness of telephone plant that damage, while widespread, was relatively light—in contrast to that suffered by others.

The Federal Civil Defense Administration estimated that damage to public and private property would exceed $234 million. And more than a month after the flood's end, they warned that their statistics would undoubtedly go upward.

There was $40 million in damage to highways and bridges. The loss of farm land, farm buildings, and livestock—not including growing or stored crops—was placed at $105 million.

The personal tragedies of the flood are in the story behind the figures compiled by the American Red Cross. They show that 29,625 families were affected, that 1,326 homes were destroyed and another 14,442 homes damaged. About 11,000 families registered with the Red Cross for financial assistance. Press estimates placed the death toll from the flood at eighty-six.

Newspapers called this the Pacific West's worst disaster since the San Francisco earthquake and fire of 1906. The acting California State Engineer said the floods were the greatest on record in Northern California, and the damage far more widespread than that in the legendary flood of 1862.

The Feather River swept away this highway bridge between Marysville and Yuba City in California. With the bridge went a major exchange cable serving Yuba City, and the aerial wire line shown.

Sand bags piled around a manhole in Yuba City, California, are protection against a second flood threat from the Feather River. Plant men were pulling in new cable to replace that lost when a bridge across the river collapsed.

As soon as the scope and seriousness of the flood situation became known, the General Administration Reports Center at Pacific Telephone and Telegraph Company headquarters was activated—at 6 A.M. on December 23. Along with similar area organizations, it became part of the far-flung battle to maintain and restore telephone service throughout stricken areas.

Men and supplies were marshalled. Plant men worked as long as they could, and then caught a few hours' rest. Within the Oregon and Northern California areas, men were shifted from the districts that had suffered little damage to those that were hardest hit. About 100 men and 83 vehicles moved into the Northern California flood zone from Southern California in truck caravans. Microwave specialists were flown in from Portland and Denver. More microwave gear was rushed from Seattle, Dallas, and El Paso. An equipment maintenance engineer from A. T. & T. visited damage sites to offer advice and assistance.

Western Electric rushed supplies by air from its manufacturing centers. From Indianapolis, 10,000 telephone sets were flown to California; from Baltimore came a plane load of drop wire; and from Philadelphia a cargo craft brought 150 batteries weighing 13,000 pounds. Other air shipments included a community dial central office from Kearny, N. J., and a main "N" carrier repeater station from Chicago. There were follow-up shipments of cable and telephone sets and other supplies, expedited by air, rail and truck to the restoration workers.

As Plant, backed by the Chief Engineer's group, strove to repair the damage done by flood waters, the Commercial and Traffic departments met challenges of their own.

Service arrangements for the emergency relief organizations, the Civil Defense authorities, and for the essential services of each community were handled through business offices. Managers helped find pumps and sand bags where they were needed. They arranged for quarters and meals for restoration workers from other locations. They uncovered scarce items like gasoline and other supplies purchased

Within six hours from the time the main fuses were pulled to protect equipment, the Santa Cruz, California, central office was dried out and in operation again. Plant men use hair dryers and nitrogen gas to dry the wiring.

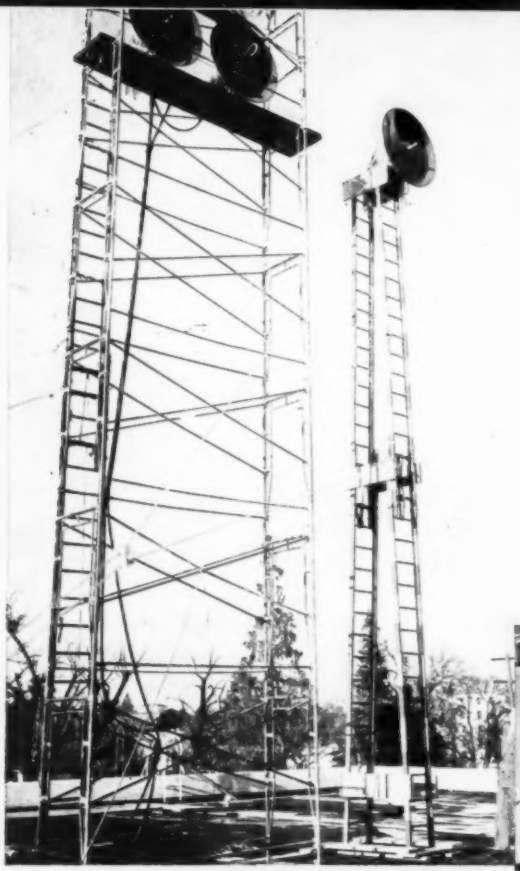
locally. One exchange manager borrowed $5000 on his personal credit from a local bank for pay advances to employees after pay checks failed to arrive. Managers everywhere kept a flow of information on the progress of telephone restoration to press, radio and TV.

Normally, traffic volumes are building up to a seasonal peak in the week preceding Christmas. Suddenly, there were literally hundreds of thousands of personal holiday plans that had to be changed. And most of them were changed by telephone calls. There were calls for food and clothing and blankets for the evacuees. There were calls for road and earth-moving equipment to clear the debris and bolster levees. Altogether, the Northern California Traffic Department reported two million long distance calls were handled in five days—a new record and about 50 per cent above normal. In the same period—December 22-26—local dial equipment handled 70 million calls. This is about 150 per cent above the normal figure.

This, then, was the broad outline of disaster and recovery. Yet everywhere the flood struck, the pattern was different. For these were rebel storms that knew no precedent. Every locality faced individual problems in restoring telephone service and rehabilitating telephone plant.

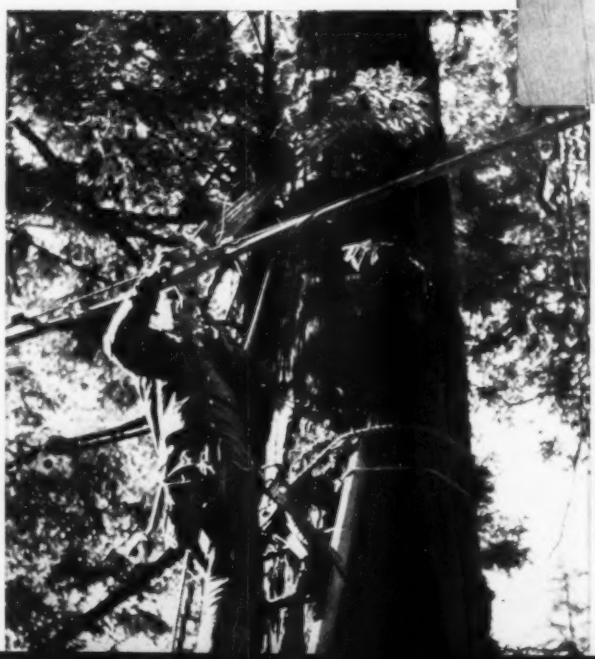
TYPICALLY, throughout southern Oregon great landslides of sodden earth were responsible for as much telephone damage as the swollen rivers. The open-wire line linking Roseburg, Oregon, with coastal communities served by a connecting company was severed by moving hillsides. Slides along the highways paralleling this long distance route stopped trucks. Linemen shouldered rolls of duplex wire weighing 60 to 80 pounds, and their tools, and started walking. Between slides, trucks were hired from farmers or loggers to carry the men and their gear. Most of the distance—34 miles—was accomplished on foot, through the mud slides that were sometimes waist deep. An estimated 80,000 feet of duplex wire was strung between December 26 and December 28 to restore this line.

Nine days later, on January 6, heavy wet snow fell over most of Oregon. Doz-



These antennas on ladders and a painter's scaffold atop the Chico central office were part of a temporary radio relay that bridged the gaps in the Sacramento-Portland coaxial cable line.

A plant man operates the temporary PBX set up at Weott to provide local service to Weott and the nearby communities of Meyers Flat and Pepperwood. Community dial offices were flooded out at all three locations.



A plant man lashes cable to a giant redwood tree near Pepperwood in the Eel River valley. Temporary expedients like this prevented further damage to the broken Oakland - Eureka, California, cable route.

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ens of new landslides burst from already scarred slopes. The Roseburg - Myrtle Point line was smashed in a dozen places. Thirty-four poles were broken and many more shoved out of line by the moving earth. Once again line crews moved out on foot, and by January 12 had restored service. As during the earlier interruption, the Eugene-Coos Bay microwave system continued to serve part of the Coast area.

Along the route of the Sacramento-Portland coaxial cable, the main north-south communication route for the Pacific Coast, slides continued to plague Plant men long after the December storms were past. South of Medford, Oregon, an earth slide caused a partial failure on January 18. Another slide threatened the same cable near Roseburg on January 23.

IN NORTHERN CALIFORNIA there were earth-slides, too. But Plant faced its greatest task in undoing the havoc of normally placid streams that almost overnight became destructive giants.

Thirty-five inches of rain fell in five days on the Eel River watershed, a stream that flows northward to the sea near Eureka, California. It winds through the giant trees of the forests known to millions of tourists as the Redwood Empire. Roughly parallel to the river and to the Redwood Highway are the open wire and the cable route that link Eureka to the San Francisco Bay cities.

Both long distance routes failed on December 22. At the same time, Eureka's only other link with the outside was lost when the connecting company line north of Eureka was knocked out. An emergency radio telephone channel with terminals at Eureka, Ukiah, and Redding was in service within hours. Meanwhile, radio relay specialists sought to set up a temporary system bridging the gap in cable.

The damage revealed when Plant crews finally were able to fight their way past high washouts and landslides was widespread. There were 10 separate breaks in the Eureka-Oakland cable within 40 miles. At one bridge crossing, 600 feet of cable was lost when a floating house tore the conduit off the bridge. For all practical purposes, the open wire was out for a 60-mile section. At the town of Weott the flood waters had swept over the top of the building that housed the cable's main N carrier system repeater station. Community dial offices at Weott, at Pepperwood, and at Meyers Flat were also flooded out.

As soon as trucks could reach Weott, an 80-line PBX was set up to provide temporary local service. An emergency trailer equipped with N carrier apparatus and its own power equipment went into action. Orders were placed with Western Electric for replacing equipment to be rushed by chartered cargo plane. Both the repeater station and the CDO equipment were a total loss. Round-the-clock work restored the Weott repeater station by January 17. The Weott dial central office went into service on January 28.

Central office equipment at Meyers Flat was cleaned, dried, and restored to service January 20. At Pepperwood, a new community dial office was activated on January 27 to replace the one damaged by the flood. In the interim, these communities had service on a toll station basis.

Meanwhile, line crews had bridged the breaks in the cable. For the most part they used neoprene-insulated inside wiring cable, stringing it on the ground and in trees and suspending it over slides and washouts. Altogether, permanent restoration required 12,400 feet of cable. At one point where the river's course shifted, a

Heavy equipment and supplies were ferried to the coaxial cable break at Rio Oso by this Army amphibious vehicle.

4,400-foot re-route over a mountain was necessary.

Along the open-wire line men were at work too. Normally this route is maintained by using motor speeders over the tracks of the Northwestern Pacific Railroad. But the tracks had been blocked by slides and washed out in many places. Helicopters moved the repair crews into the Eel River Canyon and speeders carried them along the undamaged rail sections. More than 150,000 feet of duplex wire was required to restore the breaks in this 75-mile section of line.

In the beginning, radio relay specialists had sought to bridge the gap in cable. The tremendous wind and storm damage impeded efforts to locate the line-of-sight transmission path needed. With gear flown into the area, a three-section radio relay was established on December 30, giving Eureka 12 voice-frequency circuits to the San Francisco Bay area.

THREE HUNDRED MILES SOUTH of the Eel River, the December 23 deluge spread death and destruction in the city of Santa Cruz. A beach resort town of 21,000, Santa Cruz looks out over the Pacific at the mouth of the San Lorenzo River. In summer, the river can be waded. Twelve

A north-bound caravan of telephone trucks pauses on the Redwood Highway waiting for road damage to be cleared. The Eel River area presented one of the major telephone restoration problems.

inches of rain fell on the upper watershed in the Santa Cruz Mountains in 24 hours. The soaked earth couldn't hold the water. Prehaps there would have been no flood at Santa Cruz but for the fact the swollen river met an unusually high tide at its mouth. Muddy water backed into the city's business district to a depth of three and four feet.

Plant crews hastily put up barricades of sand bags around the Santa Cruz central office, which houses a 20,000-line No. 5 crossbar switching system. In spite of sand bags and pumps, water came in through the cable vault entrance, sewers, and vents. At 3:32 A.M. on December 23 the main fuses were pulled to protect the equipment. At the worst there was 18 inches of water in the office. As the water receded, hair dryers, desiccants, and nitrogen gas were used to dry the equipment. Six hours after service was cut off, the central office was fully restored and operating.

Supplies airlifted from the Western Electric's factories are unloaded at the San Francisco International Airport.

Also flooded was the Santa Cruz business office, located in the same building. Week-end clean-up crews managed to prepare it for the first regular business day after the flood, December 27. It was one of the few businesses in Santa Cruz to open that day.

Helicopters brought men and supplies to the scene of the Sacramento-Portland coaxial cable break at Rio Oso. Tent served as temporary construction headquarters.

IN THE GREAT central valley of California, the pattern of the storm and the flood was still different. This is the broad valley of the Sacramento River and the tributary rivers that flow down from the Sierra Nevada to meet it. The twin cities of Marysville and Yuba City are astride the junction of two of these rivers, the Feather and Yuba. A little more than a 100 years ago, when they were founded by the Forty-niners, both cities were above the river level. Today—largely as a result of the once extensive hydraulic gold mining upstream that brought down vast quantities of silt—both cities are below river level. Systems of levees are necessary to protect them from flooding.

As the flood crest moved down the Feather River toward Marysville, the city prepared for the worst. Civil defense authorities ordered evacuation. Only those working on the levees and manning essential services stayed behind. Volunteers from Plant, Traffic and Commercial agreed to stick it out in the Marysville central office building that also serves Yuba City.

The Feather inched steadily up the levee banks. A bridge across the Feather between Marysville and Yuba City was swept away, taking with it a 3,000-pair exchange cable and long distance lines to Colusa and to Chico. Employees took their cars and belongings to the Yuba City side for safe-keeping and then returned to the central office. A Plant man began to set up an emergency PBX in Yuba City, in case the expected 15 feet of water should knock out the Marysville central office. Pumps were set up, sand bags thrown up around the entrances, and plywood panels put over first floor windows.

But when the levee broke, it was on the Yuba City side of the Feather River! A wall of water swept through the city, claiming 37 lives. The Plant man working on the emergency PBX escaped just ahead of the water. An estimated 4,500 telephones plus PBX's and other station equipment went under as the levee crumbled.

Even before martial law was lifted from the stricken city, new cables to replace those swept away were laid on the sidewalk of the remaining highway bridge. New telephone sets were being flown to the West Coast from Indianapolis faster than Yuba City's residents could return and repair their homes for occupancy. In fact, cable facilities and drop wires were checked out in advance of the restoration of service requests for most Yuba City subscribers. Plans are going ahead to place cables serving Yuba City in steel conduit built into the high-level bridge, where it will have the maximum protection.

IT WAS another levee break south of Marysville, near the village of Rio Oso, that carried away two sections of the vital Sacramento-Portland coaxial cable with it.

Plant crews went into action with a portable radio relay system from Chico to Sacramento that restored the L carrier system. To get dish antennas at the right height atop the Chico telephone building, 30-foot ladders were lashed together, put up, and aimed at night amid rain and wind. Later, two more antennas were added, using a painter's scaffolding. In this way 600 Sacramento-Portland circuits were restored less than 24 hours after the cable break.

With virtually the entire countryside under water, three chartered helicopters ferried men and materials to the site of the cable break on the Bear River. An outboard motorboat was used to get the first line across the break, and then aerial spans of temporary coaxial cable were

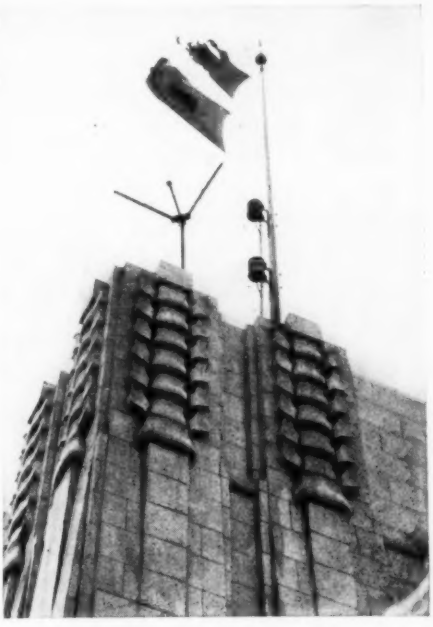
pulled in to bridge the gap. Plans for the permanent restoration at Rio Oso call for a three-mile re-route project that will remove the coaxial cable from the levee.

This re-route will be only one of many permanent changes in telephone plant brought about by the floods of December, 1955. It would be easy to assume that a weather phenomenon like this might not recur for 25, 50, or perhaps a hundred years. Instead, as it is throughout the Bell System, the policy is to profit from this flood experience by building to meet every known test that nature can devise.

Obviously, not every Pacific Telephone building can be located on ground high enough to be beyond the reach of the worst flood foreseeable. A great deal can be done, nonetheless, to prepare buildings against the possibility of flood and to have materials in emergency supply that would make them virtually flood proof.

But perhaps most significant of all the flood's lessons was the reassurance it provided of the soundness of Bell System policies and practices.

Even in the face of disaster, safety was an accepted credo. Linemen used rubber gloves, of course, where there was any danger of power crosses. And there were many instances where voltages were discovered on telephone lines and cables. In flooded areas, life jackets were everyday garb. Despite all the hazards of night work in rainstorms, driving on roads that were undermined or partially blocked by landslides, and fording flooded creeks, there was not a single lost-time accident.



Another reassurance was in the training of personnel and in the decentralization of management. In many instances, men were isolated from their headquarters; but, schooled to know their job and accept responsibility, they carried out their tasks with the competence expected of them. Restoration moved at the same swift pace.

The greatest reassurance, however, came in the aid that flowed into the flood-stricken areas from other parts of Pacific Telephone and from other companies of the Bell System. Here was strength to meet any challenge, any disaster, however great.

The hundred million mark was passed in 1955, although only 12 countries have as many as a million telephones and only eight have 15 telephones per 100 of population

TELEPHONES ARE INCREASIN THROUGHOUT THE WORLD

ELIZABETH WRENSHALL

CHIEF STATISTICIAN'S DIVISION, COMPTROLLER'S DEP'T., A. T. & T. CO.

TOTAL TELEPHONES in the world must have crossed the hundred-million mark in 1955, for the number had reached 94,500,000 by the beginning of last year and was growing rapidly. About 56 per cent of these telephones were in the United States.

Figures on total world telephones usually take about a year to gather. They are obtained by the Chief Statistician's Division of the American Telephone and Telegraph Company from some 250 telephone operating companies and administrations, many of them governmental bodies.

The number of telephones in the world increased by about 5,300,000 during 1954 —the biggest numerical increase of any year in history except 1947. That was a year in which restoration of service in war-devastated areas accounted for a considerable proportion of the telephones added. It is probable that when we get reports for January 1956, they will show 1955 to have been an even bigger year for the numerical growth in telephones.

Nearly every inhabited country has telephone service of some kind. There are, however, only twelve countries which had as many as a million telephones on January 1, 1955. As was the case the year before, only eight of the principal countries of the world had as many as 15 telephones per 100 population. The countries referred to are listed on the opposite page.

IT IS INTERESTING to look at some possible reasons why the fifteen countries in these two lists, although so diverse in many respects, have developed their telephone services to an exceptional degree. Many factors are responsible.

The physical size of a country is one of the less important factors, for out of the ten countries in the world with the largest areas, the names of only four appear on the two lists: Argentina, Australia, Canada, and the United States.

Population is a factor to be considered; yet the three most populous countries on earth—China, India, and the U.S.S.R.—had comparatively few telephones. China, for example, with nearly 600 million people,

had only twice as many telephones as Cuba. On the other hand, six of the fifteen listed countries had populations of less than eleven million each.

A high degree of industrialization is an important factor. The United States and the western European countries are industrialized and have high telephone development. But New Zealand, a non-industrialized country largely devoted to the raising of livestock, ranked fourth among the principal countries in telephone development. An even less industrialized country, Iceland, had 16.42 telephones per 100 population and a remarkably high per capita telephone usage.

Accessibility to world markets enters into consideration; yet Australia and New Zealand, both far removed from established markets, have had for many years a large number of telephones in proportion to their respective populations.

A homogeneous population should be conducive to high development. Diversity of languages would be expected to be a deterrent. But Switzerland gets along very well while handling four official languages. News reports and other special telephone services there are given in three languages.

Scientific accomplishment, cultural background, type of management of the telephone system—these and other factors have had their influence. In some areas, odd and unpredictable factors affected development, particularly in the earlier stages. In 1892, telephone circuits in one part of China were destroyed because the humming sound from the wires was believed to be made by spirits which were causing drought and sickness. In 1932, Arab engineers had to be trained in England before a telephone system could be installed in Mecca, where only those of the Moslem faith might enter.

Whatever the reasons may be, the United States has consistently led in the use of the telephone. The telephone was introduced here, as in most countries, by private enterprise. Contrary to the case in most other countries, it has continued to be administered under private enterprise. At the beginning of 1955, the United States had one telephone for every three persons, as compared with one for every 22 persons in Europe and one for every 27 in the entire world. About 70 per cent of the 47 million households in this country had telephone service.

PRINCIPAL COUNTRIES HAVING MORE THAN 15 TELEPHONES PER 100 POPULATION

1.	United States	32.21	5.	Switzerland	23.06
2.	Sweden	28.99	6.	Denmark	19.46
3.	Canada	25.05	7.	Australia	16.84
4.	New Zealand	23.29	8.	Norway	16.44

COUNTRIES REPORTING MORE THAN ONE MILLION TELEPHONES IN SERVICE

1.	United States	52,806,476	7.	Sweden	2 097,738
2.	United Kingdom	6,483,040	8.	Italy	2,036,788
3.	Canada	3,857,400	9.	Australia	1,530,680
4.	Germany, Fed. Rep.	3,445,363	10.	Switzerland	1,141,443
5.	France	2,945,564	11.	Argentina	1,080,272
6.	Japan	2,823,314	12.	Netherlands	1,021,202

XUM

IN CONSIDERING the telephone service offered in various countries, we are often asked how the charges for service in other places compare with our own. This is a difficult comparison to make. It means little to convert the charges made in different national currencies into equivalent dollars, because the purchasing power of the dollar varies greatly from one country to another. For example, ten dollars paid for a pair of shoes here might buy several pair elsewhere.

One way to get an idea of the relative costs of telephone service in different countries is to express the charges in terms of the average number of hours of work which are required for wage earners in each country to earn the price of the service. The chart opposite does this for individual-line residence telephone service in ten foreign cities, and expresses the average hours in each city as a percentage of a corresponding average for 46 United States cities. Data for average hourly earnings of factory workers, used in the computations, were taken from the "Monthly Bulletin of Statistics," published by the United Nations. The 46 United States cities are those selected by the U. S. Bureau of Labor Statistics for compilation of the Consumer Price Index. The foreign cities shown were selected from those in principal countries for which both telephone rates and earnings data were available to us.

Cable layer: H.M.T.S. MONARCH

THERE ARE certain differences between the United States and other countries with respect to the service and the methods of applying charges. For example:—

Party-line service is not used to anything like the same extent in other countries as it is here. In Argentina, Belgium, and Spain, for example, it is not offered at all. In some places (the Netherlands, Sweden, Switzerland), it is used only in remote areas. In others (such as France and the United Kingdom) it is regarded as a temporary expedient pending availability of individual facilities. In the United States, however, this type of service has contributed materially to the high level of development, for it enables families in both rural and urban communities to have telephones which they might otherwise not be able to afford.

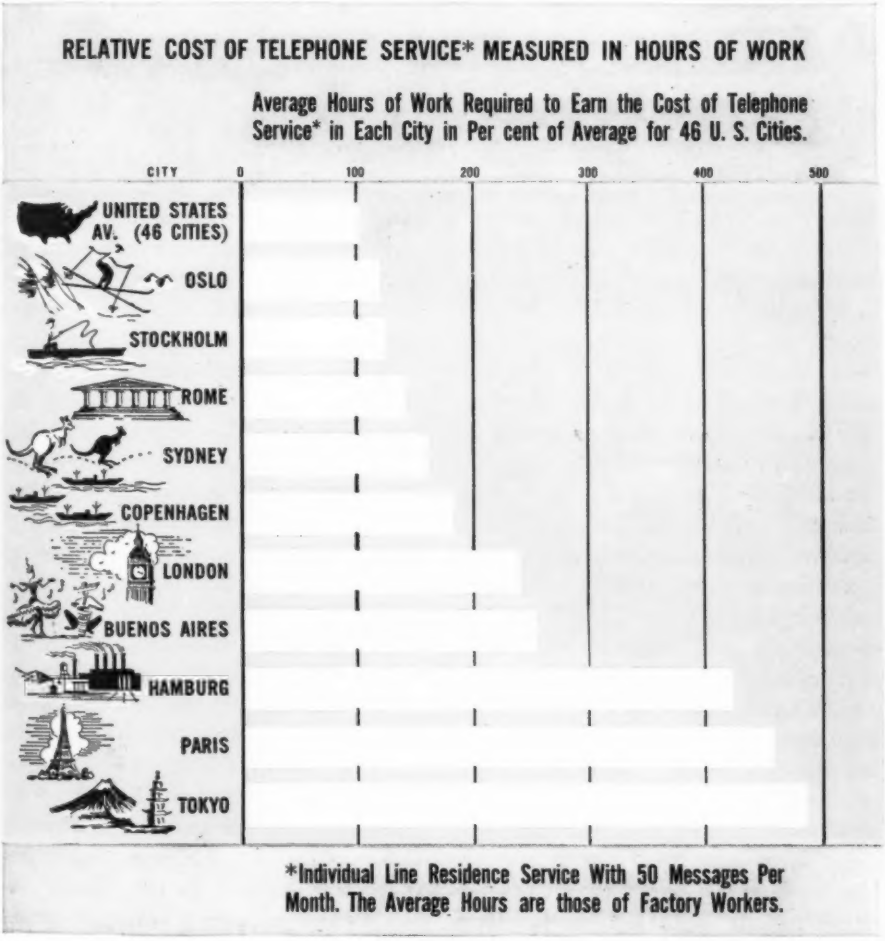
In most European countries, surcharges are applied for priority long distance calls.

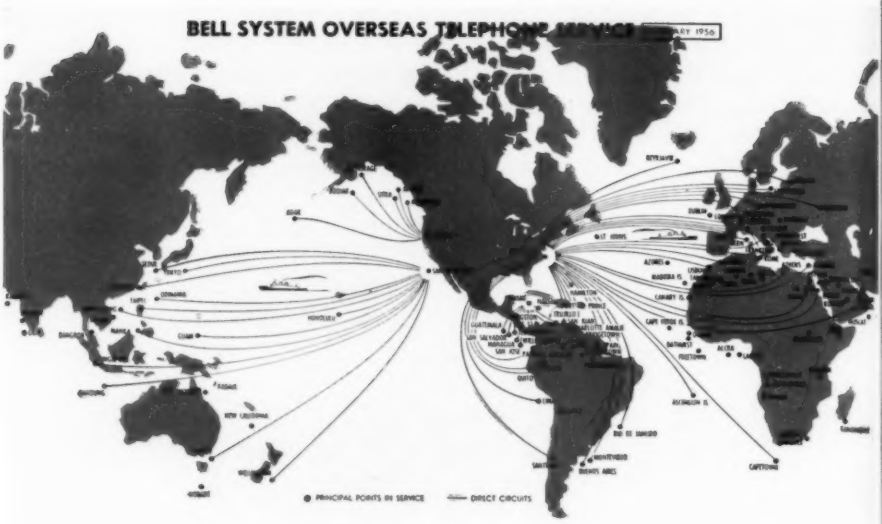
For example, an "Urgent" call may cost two or three times as much as an ordinary call, and a "Very Urgent" or "Lightning" call may cost up to twenty times as much –this latter charge being applied in Sweden. If the circuits are busy at the time a priority call is to be made, conversations established on a lower priority basis may be interrupted or terminated.

In some countries the subscription charge for service for the first year must be paid in advance, and thereafter quarterly in advance.

Security is required in some places in the form of a deposit large enough to cover the regular recurring charges and the average charges for long distance calls and other services.

Most countries have commercial service. In a few places, in Greenland for example, there is no commercial service, but certain telephone installations exist for use by





military personnel. Tibet has no telephones available to the public, but two private lines connect the capital city with towns in the foothills. Adjoining Tibet is Nepal. Straddling the border between the two countries is Mount Everest, sometimes called "the roof of the world." Nepal has only an intercommunicating system for government departmental use, as has also the Kingdom of the Yemen. These countries are studying the practicability of installing commercial service.

Development of new techniques in radiotelephony is of particular importance to countries with difficult terrain. The cost of installing and maintaining overland telephone lines in such places has been considered prohibitive in relation to the expected return. Chile—long, narrow, and mountainous—had only widely separated local systems until radiotelephony made a well-integrated system possible. Nigeria has rain-forest, woodland, and desert regions. With high temperatures, humidity, tropical pests, and miles of trackless bush which survey engineers had to cross by foot, telephone service was limited to a few isolated places. Now new equipment is being installed involving a very high frequency multi-channel radio link which will connect the capital city with places that have never before had telephone communication with the coast. Thus it may be seen that the world network is gradually spreading to parts of the earth where natural obstacles seemed insurmountable a few years ago.

THE SCOPE of international service increases each year. Whereas such service from the United States was limited to Canada, Cuba, and Mexico prior to 1927, at the beginning of 1955 a telephone user in the United States could pick up his telephone and call any one of about 91 million other telephones scattered over the world. At present, international facilities include numerous land-line circuits

to Canada and Mexico, submarine cable circuits to Cuba, and direct radiotelephone circuits to more than 60 overseas countries or areas. More than 40 additional countries or areas are reached via one of the direct-circuit points.

Progress was made in an important and dramatic new development in overseas service: spanning oceans with telephone cables. The first link of the first trans-atlantic telephone cable system was laid last summer. It is expected that this system will be completed by the end of 1956. Up to this time, transoceanic telephone service has depended on short-wave radio. However, the number of radio channels available for this purpose is very limited. The new cable system, which will furnish 36 telephone channels between North America and England, will supplement existing facilities, and will also make telephoning more reliable since it will not be subject to the atmospheric disturbances that sometimes affect today's radiotelephone service.

Work progressed on two other transoceanic cable systems. One, to Alaska, is also scheduled to be completed late this year. The other, to Hawaii, now in the early stages, is expected to be put into service in 1958.

A COPY OF THE most recent issue of "Telephone Statistics of the World," the survey of world telephone development by countries which is compiled annually by the Chief Statistician's Division, may be obtained through the Public Relations Department of the American Telephone and Telegraph Company.

INDEX NOW AVAILABLE

AN INDEX to Volume XXXIV (1955) of the BELL TELEPHONE MAGAZINE may be obtained without charge upon request to the Public Relations Department of the American Telephone and Telegraph Company, 195 Broadway, New York 7, N. Y.

The MAGAZINE is also reproduced on microfilm: one volume to a single roll of positive film, on a metal reel, suitably labeled. Inquiries concerning microfilms of the MAGAZINE should be addressed to University Microfilms, 313 N. First Street, Ann Arbor, Mich.

The Wisconsin Company's "C. T. A." program is significant for its unique teaching tools, including "manipulative materials" for a simple talking circuit

"COMMUNICATION TEACHING AIDS" FOR SCHOOLS

HAROLD S. DAY

Public Relations Manager, WISCONSIN TELEPHONE COMPANY

Note: In this MAGAZINE for Spring 1950 appeared "Adventure in Telezonia," which described the first set of teaching materials designed by telephone people, with the help of professional educators, for classroom instruction in the proper use of the telephone. That pioneer undertaking stimulated other activities in this field, intended to meet schools' requests for more information about modern communications. Such developments, in turn, have been recorded here from time to time. The program of the Wisconsin Company, described below, is the most recent in the progressive tradition of helping schools to prepare their pupils for the effective use of an essential tool of modern living: the telephone. EDITOR.

IT WAS a rainy Sunday afternoon, and six-year-old Ann was busily practicing the new skills she had acquired in first grade. Using the telephone to find a playmate, she made several unsuccessful calls and then sat quietly doing nothing. Her father, looking over the top of his newspaper, said "don't be discouraged, Ann. If you will call some more of the children, I'm sure you will find one at home." To which Ann replied "I'm not discouraged, Daddy. I have made three calls already. Now I should wait a while in case somebody else wants to use the line."

When Ann's father, who is a school principal, told us this story he added: "You, as telephone people, can find here an example of the long-term benefits in your school program. I can't promise that Ann will always be as considerate of other people as she was that day. But as an educator I can assure you of one thing. Because Ann will have frequent occasion throughout her life to use the telephone, she will never forget that lesson."

Ann's teacher was one of more than 3,000 elementary school teachers in Wisconsin who have used the Wisconsin Telephone Company's "Communication Teaching Aids" program (called "CTA") during the past four years. This program was developed as the result of many inquiries from school people, who said in effect "We think you might be helpful to the

The "C. T. A." supervisor, right, explains the workings of the Intermediate kit.

schools in a broader area than you have dealt with so far. You are, by profession, experts in an important field of communication. Can't you provide teaching tools related to the telephone which could be useful to the elementary school teacher?"

There are several factors which indicated the desirability of developing such a program with the schools. The quality (and the cost) of telephone service depends to a considerable extent upon the way in which people learn to use it. School children form a substantial part of the total population and are constant telephone users. Those same children will be our customers within a few years, and the long-term planning which characterizes other aspects of our business is just as applicable in this field. Children while in school, under professional teachers and in favorable surroundings, acquire most of the knowledge and attitudes which will direct them for a lifetime. Finally, provision of useful teaching materials may be a logical part of our responsibility for contributing to the welfare of the local community.

From the standpoint of the educator—teacher or school administrator or professor in a college of education—telephone materials can be particularly welcome. "Communication," which to the educator includes all of the ways in which human beings exchange ideas, is a broad subject which occurs again and again in the school curriculum, so that teaching aids related to communication can serve a variety of purposes.

On the basis of such considerations, it was decided to proceed experimentally with the development of Communication

Teaching Aids built on this specific philosophy: "We propose to supply teaching tools, related to the telephone, which are designed to help the classroom teacher to get *her* job done. We believe that through such tools, children will learn good usage, which will accrue to the benefit of all our customers; our Company will earn new friends; and we shall strengthen our ties with the local community."

After consultation with a number of people in the educational field, it became apparent that high-quality teaching tools should meet three criteria from the educators' point of view.

First: Teaching materials furnished by any business should be free of propaganda.

Second: Our materials should be sound in educational theory. The telephone people assigned to this project spent many hours with educational consultants in order to gain an appreciation of the objectives and the techniques in our modern school system.

From our search into the rudiments of educational theory, we found much that was helpful in designing the CTA program. We learned, for example, that Reading (one of the old original Three R's, and still a vital means of communication in modern society) is taught all through the 12 years of public school. We found that the teaching-learning process is more effective when the text book is supplemented by visual aids such as pictures, slides, film strips, and movies. We found that in the opinion of many educators, learning is improved when children come face-to-face with physical objects. One principal said "I encourage my teachers to bring into the classroom anything that can go through the door."

We were told that "manipulative devices"—things children could do with their hands—are valuable to learning; and that

The telephone provides a focal point for these second-graders.

field trips (in which teacher and class visit the museum or the factory or the telephone office) can furnish a wealth of teaching materials for classroom use.

We learned that the good teacher has only started on her duties when she imparts the Three R's and other factual information to her class. She strives to develop cooperation and character and leadership. She tries to develop an appreciation for art and music and literature. She recognizes that children, of any age, vary widely in both ability and interest; and she tries her best to adapt the lessons to each child in ways that will best develop his individual talents. Often she tackles this complex task with too large a class, with inadequate facilities, and with a burden of minor school duties. Withal, she displays a remarkable degree of ingenuity in developing teaching procedures to meet her own unique classroom situation.

This brings us to *the third criterion:* Good industry-sponsored teaching materials should not only be free from propaganda and sound in educational theory; they must also be of practical value in the classroom. The best of movies is not helpful if the teacher has no projector available, and the finest bibliography still requires access to an adequate library. For most teachers, any proposed additions to an already crowded curriculum will naturally be viewed with a jaundiced eye. However, teaching aids which will really help the teacher to get *her* job done in *her* classroom will be welcomed and used and useful.

Along with these three criteria from the educators' point of view, there is one important requirement from the standpoint of telephone company management. A program which is to provide teaching materials for the schools must contribute to better telephone service in the commun-

Seventh-graders experiment to find the best position of the transmitter

Fifth-graders watch a friendly repairman, while teacher watches for useful ideas.

ity, and thereby justify its modest place in the annual budget.

A BRIEF DESCRIPTION of the elements now used in this program will lead us quickly into concrete illustrations of ways whereby the mutual interest of school and telephone company are served.

There are four major elements in the CTA plan. First, a package of materials which is loaned to the classroom teacher and which she uses on the average during one hour a day for four weeks. Second, a visit made to the school grounds by a repairman with his truck. Third, a visit to the telephone office made by teacher and class. Fourth, the services of a young woman called the "CTA Girl" who provides the liaison between the teacher and our company.

There are three different packages: one designed for Primary use (Grades 1, 2 or 3); one for Intermediate children (Grades 4, 5 or 6) and one for Junior High School classes (Grades 7, 8 or 9). Each school makes its own decisions on the best place for CTA in the curriculum. For example, the administrators at the school which Ann attended, decided to use the Primary Kit in the First Grade.

If you were to open the several boxes which comprise an Intermediate package, you would find a Teacher's Manual, booklets for the children, other booklets for the teacher, film strips, a catalog of films (including "Adventure in Telezonia", "Mr. Bell," and "Party Lines") available upon request to the CTA girl, and other items.

The children are especially interested in six telephone handsets and six boxes containing parts, with illustrated instruction showing how the parts and the handsets may be assembled to make "telephones that really work." This simplified telephone instrument (nicknamed the "70 set") will talk no more than a few hundred feet, and its appearance would hardly grace your living room, but it is more useful to the teacher than a standard telephone. Let's explore its potentialities.

The real and familiar physical object which is the handset stimulates interest. The assembly of the 700 set provides an absorbing project in which the children do active work with their hands. Having six sets, the teacher can divide her class into six working groups. Such group activity is in itself a useful teaching tool; but let's proceed further.

The assembly process provides a strong incentive for reading, for the instructions are complete but precise and any carelessness may result in an instrument that does not work. Many teachers have said "When you realize how many times during the child's life he will be required to read and understand and follow written instructions, this discipline alone makes the assembly process worth while."

Again, the assembly of the 700 set often brings into prominence the boy (or girl) with outstanding mechanical skill. Billy puts his telephone together quickly, then volunteers to help the other children, then becomes the Chief Electrician Responsible For Removing Batteries at the end of the class period. Perhaps Billy has been slow in reading; but here is something in which he excels, and his newly found prestige may well help him in other areas.

A pair of 700 sets may be interconnected through a little "switchboard," and with the six sets three simultaneous conversations may take place. These are not just toys for the children to play with, but teaching tools for a variety of purposes. Use of the telephone directory, party line courtesy as an example of good citizenship, "props" for a class play, models for art work, an example of an electrical circuit: the 700 set has aided teachers in all these ways and more.

In third grade, the technique of assembling the telephone parts would be too difficut, so the sets are delivered ready for use. In ninth grade, the 700 sets move into the background and there are instructions for building a "carbon-stick microphone" as an aid in understanding the scientific principles involved in Mr. Bell's invention.

IT SHOULD BE NOTED that the simplified telephone with its variants is not essential to the CTA idea, but is rather an example of teaching tools useful in a classroom.

When the repairman brings his truck to the school grounds, he provides valuable learning experiences on which the skillful teacher can build lessons in safety and courtesy and orderliness, in good telephone usage, and in respect for telephone plant.

The class visit to the telephone office brings to each child the thrilling experi-

A "do-it-yourself" microphone helps science students to understand how the telephone works.

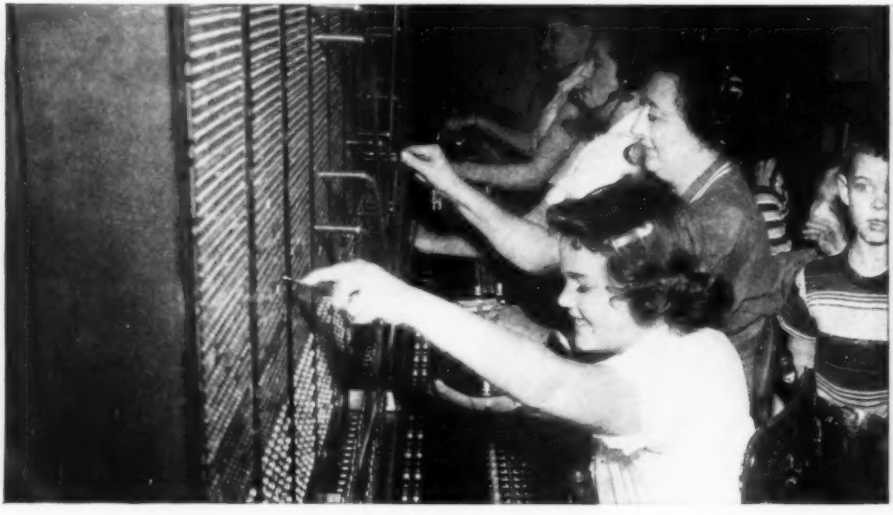
ence of "playing operator"; actually completing a call through the real switchboard from one student to another. Upon this experience the teacher builds thank-you letters and themes, scrapbooks and drawings, home-made "movies" and dramas, lively discussion of the people who serve the local community, and so on.

One particular facet of the CTA theory and its application involves those telephone people who deal with the school children and their teachers. Perhaps the oldest principle in education is that "we teach more by example than by precept." When most of the fifth grade children from Liberty School want to be operators, we may be sure that the Traffic guides made a good impression. When a small boy writes to the repairman, "I like your truck. I like your tools. I like you," and his teacher says "your telephone man ought to be a school teacher," and his mother says "Tommy has all the kids in the block playing telephone man," we are making new and lasting friends in the community. And when the superintendent of schools tells us "Your CTA girl is friendly and helpful, welcome in any classroom, the vital element in your program," there is definite evidence that we have good-will ambassadors in this area of our public relations.

THIS BRINGS US to an appraisal of results. We found early in our field trials that the CTA idea was welcomed by teachers and school administrators. It has been offered to over a hundred autonomous school systems, only one of which preferred not to try it; and no school system having used the program has discontinued it.

We found that the entire program is enthusiastically welcomed by the children themselves—which is certainly one indication of good teaching material.

Careful investigation by various school authorities resulted in an educator's accolade: an article in the *Wisconsin Journal of Education* signed by a telephone representative.



Ten years from now, she may be The Voice with the Smile.

Depth-interview surveys made recently by an outside agency with a random group of school administrators and a random group of teachers showed unanimous approval.

Two surveys have been made to determine the reaction of parents. In the Spring of 1953 we arranged, with the cooperation of school friends in that community, to saturate Stevens Point (population 15,000) with CTA: some 87 teachers used the program within two months. A telephone survey was made covering 700 residence customers—half of them with children who had taken CTA instruction. Ninety-six per cent of the parents approved of the plan, and 94 per cent of the non-parents also approved!

In February of 1955 a survey was planned, under the careful guidance of our statisticians, which covered 20 groups of parents in 12 different communities. Not only did the parents indicate better than 95 per cent approval; they explained in some detail *why* they approved. Here are some typical comments:

"It teaches the children how to use the telephone correctly and not to misuse it in any way. It also gives them a better understanding of how the telephone is used in America."

"Every child should know how to use the telephone properly."

"At times strangers can teach children better than parents. It seems that they remember things better when taught how things work."

"Always good for children to have experience of daily living—also good for them to appreciate what services are offered by the community."

"They need to know how to use it properly, they start now at such an early age."

"My child has taught *me* how to use the telephone."

"We feel safer leaving the children alone, because now they understand how to use the telephone in an emergency."

"My child has told me of the large staff of personnel it takes to give us such service. He visited the company and sent out test messages and thought it was wonderful. It surely teaches the child a lot."

"Telephones are a natural and important part of everyday living, no matter what the field of business or what vicinity we live in, therefore it's of great importance to teach our children the proper use of them."

There is at present no tangible and objective means for measuring just how much CTA does to improve telephone service in a community. However, all of the opinions concerning it are favorable; both from the public and from telephone management people who have had direct contact with it. The underlying philosophy seems sound; and if so, CTA will find its place in a constructive, long-term public relations program.

XUM

THE ART AND SCIENCE OF MODERN ELECTRONICS: A BOOK REVIEW

WILLIAM H. DOHERTY

Assistant Vice President, MERCHANDISING DEPARTMENT, A. T. & T. CO.

"ONE CANNOT BE IN TUNE with his age without understanding something of science . . ." says the author of *Electrons, Waves and Messages.* What he does not add is that many an engrossed scientist too can profit from an occasional visit to fields outside his own investigation. Such an excursion, expertly conducted, is offered by this book. The teacher of science will likewise find the book a refresher, for its disclosures are generously studded with illustrative gems from the present-day technological world on which the author is so well informed and up to date. Even his modest confessions of unfamiliarity with some fields are phrased to excite interest therein.

On this highly interesting tour Dr. Pierce leads the reader through quite a number of diverse problems that science attempts to solve, most of them involving electronics in one way or another. The simple laws of motion and gravitation, and the behavior of familiar kinds of waves, are reviewed and carried over to analogous phenomena in electron motion, electric and magnetic fields, and the electromagnetic waves of radio. Where a small amount of mathematics is helpful, as in understanding Maxwell's Wonderful Equations, it is developed from what almost any reader will remember. When the going gets difficult the author, being completely honest, frankly turns to a new subject rather than mislead the layman by oversimplification.

From the rudiments of conventional electron tube operation the reader is introduced to special high-frequency tubes including the traveling wave amplifier—on which the author is a foremost authority. Interest in these is heightened by lucid discussion of the importance of extremely wide frequency bands for satisfying the multifarious needs of an increasingly communication-minded and automatized society. Sections dealing with signals and noise and with statistical communication theory are a masterful blend of technical soundness and entertaining writing. The reader is given an idea of the concepts of relativity and wave mechanics and their relation to the new devices of solid state electronics. He is finally treated to an imaginative account of what the future may hold, with emphasis on television in many possible forms, and on communication between machines. No one, however, recognizes more clearly than John Pierce that new discoveries, or more experience with old ones, may profoundly affect future trends. And no one acknowledges more humbly the contribution of systems engineers who conceive and work out great complex operating assemblies, of which the devices coming out of the science laboratory are constituents.

Dr. Pierce directs a broad program in communications research at Bell Telephone Laboratories, including fundamen-

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ELECTRONS, WAVES, AND MESSAGES. *By John R. Pierce. 318 pages including Preface and Index. Hanover House. $5.00*

tal work in acoustics, television, multiplex transmission, and electronic switching. He is widely known for his ability to explore and map out possibilities in fields as seemingly remote from his own as astronomy and space travel. Telephone people reading his latest work will take satisfaction that the environment they work in, with its infinite technological and human complexity, is the backdrop for most of his observations and the springboard to others: for example, his demonstration that a microwave link to the moon, if there were a lunar audience to enjoy its use, would be much simpler than our coast-to-coast microwave television system. Not the least of the rewards of reading this fascinating and thoughtful new book is a better acquaintance with its very human and many-sided author.

Who's Who & What's What

(*Continued from page 3*)

ing World War II and with the Defense Production Administration in 1951. He has helped to plan and has participated in teaching executive development courses at the universities of Wisconsin and Georgia, as well as the Carnegie Program for Executives. He is a consultant to the Office of Defense Mobilization on matters affecting national defense, and to several business concerns on management, marketing, and executive development problems.

HITCH-HIKING rides in row boats and helicopters to follow Plant workers on their flood restoration tasks is responsible in part for M. K. JORDAN's ability to write authentically about last Winter's storm damage in California. On flood assignment he worked with the Commercial manager at Marysville-Yuba City on press and photo coverage. On his permanent assignment he divides his time between the *Pacific Telephone Magazine* and the headquarters News Bureau in San Francisco. Mr. Jordan's interest in the telephone business stems from three years in the Signal Corps during World War II. He was a lineman and served overseas in India-Burma. As a reporter and deskman, Mr. Jordan worked on several daily newspapers in California during the five years before he joined Pacific Telephone.

Elizabeth Wrenshall

THE ABILITY to add variety to the essential qualification of accuracy makes ELIZABETH WRENSHALL's annual contribution about telephone statistics of the world doubly welcome to these pages. The current is her seventh article, and, regrettably, the editor is unable to lend the same variety to successive statements of her Bell System career. It must suffice to note, therefore, that she was a teacher in schools abroad before World War II and a translator for censorship authorities during that struggle, and has been a member of A. T. & T.'s Headquarters group since 1945. Her ability with foreign tongues is a great asset in

gathering and compiling the data which she uses in her daily activities.

ENGINEERING, Plant, Western Electric, Traffic, Commercial, Public Relations: those are the departments, in that order—and that's most of them—in which HAROLD S. DAY has served since he joined the Wisconsin Telephone Company as transmission engineer in 1920. In the nearly 36 years and the many positions since then, employment and training have been the interests occupying most of his time and thought and energy. In the Public Relations Department since 1950, as public relations supervisor and—since 1954—P. R. manager, he has been primarily concerned with the use of lecture demonstrations in presenting technical telephone material to lay audiences and with the development of telephone teaching materials designed to meet elementary school needs.

William H. Doherty

A MEMBER OF the Bell Telephone Laboratories since 1921, WILLIAM H. DOHERTY's early work in the field of high-power radio transmitter development for transoceanic service and broadcasting led to the invention of a high-efficiency power amplifier now extensively used in broadcasting. By 1949 he had become director of electronic and television research, and was made director of research in electrical communications in 1952. Last August he was named assistant vice president in A. T. & T.'s Merchandising Department, in charge of facilities and instrumentalities.

Harold S. Day

HEADQUARTERS SUMMARY

Dec. 15, 1955, to March 15, 1956.

THE MANUFACTURE of aluminum conductor cable is being resumed on a limited basis, with a maximum annual production rate of about 5 BCF as the present objective. The maximum size of all of these cables is 1.6 inches, which permits the use of T-type cable terminals and splice cases in aerial construction.

THE System-wide Toll Fundamental Plan Study is a long term study intended as a guide for current engineering and development of the nation-wide toll network. Parts One and Two of the Study (CSP Selection Studies and Tentative Selection of CAMA Locations) were completed some time ago.

Part Three, "Notes on Homing Arrangement Procedures," which has now been completed, was issued to the Companies on March 1. It will furnish needed guides, for current planning, of the economic balance between transmission and switching facilities. When results of all Companies' Part Three Studies are consolidated, they will form the basis for Part Four of the Toll Fundamental Plan Study, a Nationwide Intertoll Trunk Study.

SINCE INAUGURATION of TD-2 microwave service on the New York-Chicago system in 1951, troubles caused by vacuum tube failures have been greatly minimized. This is due in large measure to improvements made by the Laboratories and Western Electric in the 416-type vacuum tube. This tube is unique in that it was the first commercial triode built to operate at frequencies as high as 4,000 megacycles. Such operation was made possible by maintaining extremely small clearances between tube elements—only .0005" spacing between the grid wires and the cathode. About 23,000 such tubes are now in service in the TD-2 microwave facilities.

In 1952 the 416A tube then in use was quite costly and had an average life of 4,500 hours. The improved model, coded 416B, was introduced in 1952 and it has now replaced the 416A's in the plant. "In service" cases of tube failure dropped by more than 5 to 1 with introduction of the new tube, and the average life is about 11,000 hours. Annual savings in replacement tube costs alone are estimated to be in excess of $1,000,000. In addition to providing marked improvement in performance, the price of the 416B tube is much less than the earlier one.

NEW TEST EQUIPMENT is being made available to outside plant forces which will permit identifying working as well as non-working cable conductors by one man. Such equipment enhances the effectiveness of one-man splicing crews.

NEW TYPES of equipment arrangements have been developed for providing Speakerphone service in conjunction with the regular types of key telephone sets, hang-up sets, wall sets, etc., without the need for using separately mounted keys or a separate Speakerphone telephone set. These arrangements will utilize a newly introduced microphone transmitter unit with control buttons, which is entirely separate from the telephone set and houses the microphone and controls formerly available only in the Speakerphone (592 type) telephone set.

The new transmitter unit (656-A) is similar in general appearance to the loudspeaker receiver unit now used in conjunction with the Speakerphone telephone set. The general transmission performance is expected to be substantially the same as that being experienced with the present Speakerphone arrangement.

THE CALL OF A. T. &. T. Convertible 3-3/4s of 1963 for redemption of 106 on May 1 leaves the Company once again with but one convertible issue outstanding. In view of the spread of some $30 or more between the call price and the market price of the called debentures, of which only $18 million was left outstanding on the call announcement

date, the Company made intensive efforts to see that holders of the issue were aware of the call and of the fact that it was to their advantage to either sell or convert by the redemption date. These efforts included the mailing of about 23,000 explanatory letters to original subscribers who received debenture pieces known to be outstanding. Advertisements in various forms were placed in newspapers in 20 cities and in many financial magazines, and banks and brokers were circularized concerning the call. Conversions of the new Convertible 3-7/8s of 1967 in the first four months totaled about $400 million, or 63 per cent—better than for any earlier post-war issue.

THE A. T. & T. ANNUAL REPORT is one of the most widely distributed business publications in the country. Some 1,673,000 copies of the Report for 1955 were printed. Besides going to more than 1,415,000 share owners, 115,000 copies have been distributed to banks, brokers, libraries, and others interested. This leaves some 143,000 copies for filling further needs during the year, including one copy each for all future new share owners. The 1955 report was the first to include photographs in color, and was more fully illustrated than reports of past years.

WHEN "Salute to Eisenhower" dinners were held across the country on January 20 in honor of the President, a closed TV network enabled him to chat face to face with fans at many of the gatherings. The two-way program brought the President in Washington to dinners in 47 cities from coast to coast, and also made it possible for him to view the festivities in 11 cities extending from Portland, Ore., to Atlanta, Ga. This was the largest number of combined video and audio pick-ups ever handled by the telephone industry on a closed circuit TV program.

THE DEPENDENCE of television programs and hundreds of telephone conversations on the reliability of the TD-2 microwave radio relay system makes it mandatory that transmission over the system be uninterrupted. Automatic protection switching, developed at the Laboratories, acts as a super-watchman with very fast reflexes. Should fading or other trouble occur on the microwave system, this watchman takes the necessary action to substitute a protection channel for the channel in trouble, and does it so fast that television viewers and telephone users are usually unaware of the change.

THE NEED for more long distance circuits, especially in the range up to about 200 miles in length, has increased rapidly in the post-war era. Type N carrier, developed since the war for just such applications, found its way blocked in many existing cables by the presence of the older long-haul Type K systems, with which there would be mutual interference with each other's operation. Engineering studies made by the Laboratories and the O. & E. Department resulted in engineering practices to permit joint application of Type N and Type K in the same cables, greatly enhancing the capabilities of both types in meeting the demands for new circuits.

THE WESTERN ELECTRIC COMPANY has purchased a five-story building in downtown Omaha, Neb., as a step toward the construction of an entirely new factory in that city. The building purchased will be used to train a nucleus of personnel for the new factory, and meanwhile will provide additional manufacturing capacity.

The proposed new plant will have approximately 1,000,000 square feet of floor space, and will consist of two modern factory buildings and an administration building, devoted to the manufacture of dial central office equipment and exchange area telephone cable. When ready for operation, probably in 1959, it is estimated that it will employ from 3,000 to 4,000 people.

Western has also signed a five-year lease for a 300,000 square foot building in Fairlawn, N. J., as a new satellite location of the Kearny Works. It will be used for the manufacture of telephone switching equipment and electronic circuit components, as well as office and storage space.

WESTERN ELECTRIC'S Greensboro, N. C., Shops in January completed 10,000,000 consecutive man hours of work without a disabling work injury. This is a higher figure than has ever been reached before by any Western Electric location under present methods of measuring safety experience. The unbroken period dates back to April 8, 1952. Western as a whole has established an imposing safety record. During 1955, a total of 28 National Safety Council awards were received by 21 Company locations.

The Blue Pencil

"THE WORLD DO MOVE"—and faster now than when the events of their day buggy-dashed past the observant old-timers who used to voice that cogent observation. The telephone—if it then existed—probably didn't occur to them as illustrative of the point. But it was used last March by the Voice of America, on the occasion of the 80th anniversary of the telephone's invention, to indicate to Iron Curtain countries the progress which eight decades have brought to the Free World. Using a model of Bell's first telephone, loaned by A. T. & T., representatives of the Voice reported in French, German, Spanish, Chinese, and English that they had a replica of the original instrument before them, and then spoke through it to describe the telephone's invention. They then switched back to a modern instrument to demonstrate the improvement in speaking quality and tell a bit about the growth of communications in the United States.

The contrast might have been thought-provoking to some telephone users this side the Iron Curtain too, we imagine.

THE THINGS Harold Day tells us in this issue about what the Wisconsin Company is doing in that State's grade schools to further the intelligent use of the telephone by the younger generation make first-rate reading. If testimony were needed as to its value, parents and teachers supply it on his last page. But what about the other parties most concerned—the youngsters? There the author speaketh not. Other sources are open to us, however, and we present herewith one piece of evidence which we feel says a good deal in Harold Day's behalf—if that were necessary, which it isn't.

"November 25, 1955

"Dear Mr. Bell:

"We, the children of Room 205, want to thank you for inventing the telephone. It saves time, lives, and gives us much pleasure. We don't see how we could get along without it. We appreciate the time and work you put into it. Thank you again and may you rest in peace. We will remember you in our prayers.

"Room 205"

REMEMBER THE PICTURE of the hurricane warning flags which appeared on this Magazine's cover last Autumn? We still hear occasionally from or about it—with pleasure, of course. Now along comes the pair on the tower of the Pacific Tel & Tel building in San Francisco—as reproduced on page 43. They are the real thing, and we are beginning to wonder whether we started a trend—or whether it's just a coincidence we have here.

DO ALL *commercials*, whether encountered on radio programs or TV, irk you? Then, we submit, you don't listen often enough to the Bell System's TELEPHONE HOUR. For its commercials, which are what justify the programs, are regularly in good taste, restrained in message and delivery, and often downright delightful. As, for example, this, called "Growing Time" and committed to the air-waves on March 26:

"Spring is many things to many people. Telephone people know it well.

"It is music . . . the sound of choirs in churches and temples everywhere, the song of birds on the wing, the lilting ripples of brooks dancing through greening fields. It is the season of youth and the young. It is a kite bobbing on a puff of wind, and mud-pies cupped in a tiny hand.

"Spring is the look of things . . . the shine of a sunny day, faces seen through a rain-splashed window, and the smiles of those in love. It is the smell of the fresh earth turned in your garden . . . for Spring is the season of growing things, in nature and under the hand of man.

"Just look around you. The fellow next door may be putting on a porch. Perhaps

there's a new road being cut through at the end of the street. And on that road will be houses, stores, factories.

"To telephone men and women, this growth means more telephones—more new construction and more new equipment, to serve more and more people, to grow with your community.

"To you, and to your neighbors at the telephone company, Spring means opportunity—a welcome opportunity to work with you to make better the land in which we live. It is a time for which we are all humbly thankful."

The big news is, of course, that TELEPHONE TIME—described in our preceding issue—is now on the air, Sunday evenings. But we are glad the Telephone Hour is still with us Monday evenings at nine, to bring us in low key such good and pleasant items as this. As you may judge, we like it. Don't you?

THE COVER which Henry Stoessel, a leading New York designer and illustrator, has painted in oils for this issue is as symbolic as the beholder wishes it to be. To us, it says simply that on the inside pages will be found a stimulating discussion of the place of science —and, more particularly, of Bell Telephone Laboratories—in the future of the telephone industry.

NO MAN can retire from his Bell System employment without receiving the good wishes of his associates, often conveyed at a gathering or reception appropriate to the occasion. Few of them, however, no matter what their occupation nor how high they have risen nor how important the part they have played in the telephone's history, can be credited with so specific a contribution to Bell System progress as Ralph Bown, whose friends hailed him on his retirement as the one individual most responsible for the development of radio relay—"a new form of communication." They did so by means of the "testimonial" reproduced in miniature below, and the names appended continue on below the ones shown here.